



IMPERIAL INSTITUTE  
OF  
AGRICULTURAL RESEARCH, PUSA.







**NATIONAL INSTITUTE OF AGRICULTURE**  
**AGRICULTURAL INTELLIGENCE AND PLANT DISEASES**

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**ORIGINAL NATIONAL REVIEW**  
**OF THE SCIENCE**  
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## THE INTERNATIONAL INSTITUTE OF AGRICULTURE

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The International Institute of Agriculture was established under the International Treaty of 7 June 1905, which was ratified by forty governments. Twenty-two other governments have since adhered to the Institute,

It is a Government institution in which each country is represented by delegates. The Institute is composed of a General Assembly and a Permanent Committee.

The Institute, always confining its attention to the international aspect of the various questions concerned, shall :

(a) collect, study and publish as promptly as possible, statistical, technical, or economic information concerning farming, vegetable and animal products, trade in agricultural produce, and the prices prevailing in the various markets ;

(b) communicate the above information as soon as possible to those interested ;

(c) indicate the wages paid for farm work ;

(d) record new diseases of plants which may appear in any part of the world, showing the regions infected, the progress of the diseases, and if possible, any effective remedies ;

(e) study questions concerning agricultural co-operation, insurance and credit from every point of view ; collect and publish information which might prove of value in the various countries for the organization of agricultural co-operation, insurance and credit ;

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- South Carolina : Clemson College : South Carolina Agric. Exp. Sta. of Clemson Agric. College : 1. Bulletin. — 2. Annual Report.
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- Utah : Logan : Agricultural College Exp. Sta : 1. Bulletin. — 2. — Circulars. — 3. Annual Report.
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## VENEZUELA.

- Boletín del Ministerio de Fomento* Caracas.

# WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES WITH THEIR ENGLISH EQUIVALENTS.

1 Archine (Russia)	=	27.99961 inches
1 Ardeb (Egypt)	=	5 44435 bushels
1 Ardeb of wheat (Egypt)	=	2.95264 cwt.
1 Ardeb of hulled maize (Egypt)	=	2 75580 cwt.
1 Ardeb of barley (Egypt)	=	2.36211 cwt.
1 Ardeb of undecorticated rice (Egypt)	=	5.72812 cwt.
1 Ardeb of decorticated rice (Egypt)	=	3 83813 cwt.
1 Arpent (Canada)	=	0.84501 acres
1 Are [100 square metres]	=	107 63915 square feet
1 Arroba (Brazil)	=	33 06951 lbs
1 Arroba (Cuba, Guatemala, Paraguay, Peru)	=	25 35841 lbs
1 Arroba (Mexico)	=	25.36657 lbs
1 Bale of cotton (Brazil)	=	396.83415 lbs
1 Bale of cotton (United States)	=	4 46431 cwt (gross wt.)
1 " " " " "	=	4 26788 cwt (net wt.)
1 Bale of cotton (India)	=	3.57145 cwt
1 Barrel of wheat flour (Canada, United States)	=	1 75001 cwt.
1 Bar, see Millier		
1 Bow (Java, Dutch Indies)	=	70.36998 square feet
1 Bushel (United States)	=	0 06896 bushels
1 Bushel of oats (United States)	=	32 lbs
1 Bushel of oats (Canada)	=	34 lbs
1 Bushel of wheat and potatoes (United States)	=	60 lbs
1 Bushel of barley (Canada, United States)	=	48 lbs.
1 Bushel of raw rice (United States)	=	45 lbs
1 Bushel of rye, hulled maize, linseed (Canada, United States)	=	56 lbs
1 Cadastral arpent (Hungary)	=	1 42201 acres
1 Cental (United States)	=	100 lbs
1 Centiare [10 square metres]	=	10 76392 square feet
1 Centigramme	=	0 15431 grains
1 Centilitre	=	0 0022 gallons
1 Centimetre	=	0 393715 inches
1 Centistere	=	0 35315 cubic feet
1 Centner (Germany, Austria, Denmark)	=	110.23171 lbs
1 Centner (Sweden)	=	93 71238 lbs.
1 Cho [60 ken] (Japan)	=	119 30327 yards
1 Cho (Japan)	=	2.45068 acres
1 Crown [100 heller] (Austria-Hungary)	=	10 d at par
1 Crown [100 öre] (Denmark, Norway, Sweden)	=	18 1 1/2 d at par
1 Cubic centimetre	=	0.06102 cubic inches
1 Cubic metre	=	1.30795 cubic yards
1 Decagramme [10 grammes]	=	0.35275 oz.

# LX WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES

1 Decalitre [10 litres]	=	2.19976 gallons
1 Decametre [10 metres]	=	32.80840 feet
1 Decare [1000 square metres]	=	1195.98627 square yards
1 Decastere [10 cubic metres]	=	13.07951 cubic yards
1 Decliare [10 square metres]	=	11.95986 square yards
1 Deciatine [2 tchetwert] (Russia)	=	2.69966 acres
1 Decigramme	=	1.54323 grains
1 Decilitre	{	= 0.022 gallons
		= 0.0027497 bushels
1 Decimetre	=	3.93701 inches
1 Decistere	=	3.53146 cubic yards
1 Dinar, gold [100 para] (Serbia)	=	9 <sup>11</sup> / <sub>16</sub> d at par
1 Dollar, gold, \$ [100 cents] (United States)	=	4 s 1 <sup>1</sup> / <sub>16</sub> d at par
1 Drachm, gold [100 lepta] (Greece)	=	9 <sup>11</sup> / <sub>16</sub> d at par
1 Dz. = Doppelzentner (Germany)	=	220.46341 lbs.
1 Egyptian kantar (Egypt)	=	99.04980 lbs.
1 Feddan Masri [24 Kirat Kamel] (Egypt)	=	1.03805 acres
1 Florin, gold, or Gulden [100 cents] (Netherlands)	=	1 s 7 <sup>11</sup> / <sub>16</sub> d at par
1 Franc [100 centimes] (France)	=	9 <sup>11</sup> / <sub>16</sub> d at par
1 Gallon (United States)	=	0.83270 gallons
1 gramme	=	0.03527 oz.
1 Hectare [10 000 square metres]	=	2.47109 acres
1 Hectogramme (100 grammes)	=	3.52746 oz
1 Hectolitre [100 litres]	{	= 21.99755 gallons
		= 2.74967 bushels
1 Hectometre [100 metres]	=	109.36133 yards
1 Hectostere [100 cubic metres]	=	130.79505 cubic yards
1 Jarra (Mexico)	=	7.22642 quarts
1 Kadastral hold, see Cadastral arpent		
1 Kin (Japan)	=	1.32278 lbs.
1 Kokou [10 to] (Japan)	=	1.58726 quarts
1 Kokou of oats (Japan)	=	1.55014 cwt.
1 Kokou of cocoons (Japan)	=	82.67268 lbs.
1 Kokou of wheat and maize (Japan)	=	2.58356 cwt.
1 Kokou of barley (Japan)	=	2.06685 cwt.
1 Kokou of naked barley (Japan)	=	2.69428 cwt.
1 Kokou of rice (Japan)	=	2.80501 cwt.
1 Kopek (Russia)	=	1 <sup>1</sup> / <sub>160</sub> farthing at par
1 Kwan (Japan)	=	8.26738 lbs.
1 Lei, gold [100 bani] (Rumania)	=	9 <sup>11</sup> / <sub>16</sub> d at par
1 Leu [100 statinki] (Bulgaria)	=	9 <sup>11</sup> / <sub>16</sub> d at par
1 Lira [100 centesimi] (Italy)	=	9 <sup>11</sup> / <sub>16</sub> d at par
1 Litre	{	= 0.21998 gallons
		= 0.0275 bushel
1 Manzana (Nicaragua, Guatemala)	=	1.72665 acres
1 Mark [100 Pfennige] (Germany)	=	11 <sup>1</sup> / <sub>16</sub> d at par
1 Mark [100 penni] (Finland)	=	9 <sup>11</sup> / <sub>16</sub> d at par

1 Maund Factory (India)	=	74.6709 lbs.
1 Maund Imperial (India)	=	82.28136 lbs.
1 Metre	=	3.28084 feet
1 Milliare	=	1.07639 square feet
1 Milligramme	=	0.01543 grains
1 Millilitre	=	0.00022 gallons
1 Millimetre	=	0.03937 inches
1 Millistere	=	61.02361 cubic inches
1 Myriagramme [10 000 grammes]	=	22.04634 lbs.
1 Myrialitre [10 000 litres]	=	2 199.75539 gallons
1 Myriametre [10 000 metres]	=	274.96701 bushels
1 Millier [1 000 000 grammes]	=	6.21373 miles
1 Milreis, gold (Brazil)	=	19 68426 cwt.
1 Milreis, gold (Portugal)	=	28 2 <sup>91</sup> / <sub>100</sub> d at par
1 Minot (Canada)	=	48 5 <sup>10</sup> / <sub>100</sub> d at par
1 Morgen (Cape of good Hope)	=	1.07306 bushels
1 Muid (Cape of good Hope)	=	2 11654 acres
1 Oka (Greece)	=	24 gallons
1 Oke (Egypt)	=	3 bushels
1 Peseta, gold [100 céntimos] (Spain)	=	2.75579 lbs.
1 Peso, gold [100 centavos] (Argentina)	=	2 75138 lbs.
1 Peso, gold [100 centavos] (Chili)	=	9 <sup>23</sup> / <sub>100</sub> d at par
1 Pic (Egypt)	=	38 11 <sup>39</sup> / <sub>100</sub> d at par
1 Pikul (China)	=	18 5 <sup>61</sup> / <sub>100</sub> d at par
1 Pikul (Japan)	=	2 46646 feet
1 Poud (Russia)	=	133 27675 lbs.
1 Pound, Egyptian, gold [100 piastres]	=	132 27805 lbs.
1 Pound, Turkish, gold [100 piastres] (Ottoman Empire)	=	36 11292 lbs.
1 Pund (Sweden)	=	£1.0 6 <sup>49</sup> / <sub>100</sub> d at par
1 Quintal	=	188 0 <sup>51</sup> / <sub>100</sub> d at par
1 Rouble, gold [100 kopeks] (Russia)	=	0 73712 lbs.
1 Rupee, silver [16 annas] (British India)	=	1.06843 cwt.
1 Square metre	=	28 1 <sup>3</sup> / <sub>100</sub> d at par
1 Stere [1 cubic metre]	=	18 4 d at par
1 Sucre, silver (Ecuador)	=	1 19599 square yards
1 Talari [20 piastres] (Egypt)	=	1 30795 cubic yards
1 To (Japan)	=	18 11 <sup>51</sup> / <sub>100</sub> d at par
1 Ton (metric)	=	48 1 <sup>11</sup> / <sub>100</sub> d at par
1 Verst (Russia)	=	0 40601 bushels
1 Yen, gold [2 fun or 100 sen] (Japan)	=	3.06815 gallons
1 Zentner (Germany)	=	0.98421 tons
	=	1166.64479 yards
	=	28 0 <sup>37</sup> / <sub>100</sub> d at par
	=	110.23171 lbs.



*In quoting articles, please mention this REVIEW.*

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# EDITORIAL STAFF OF THE BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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INTERNATIONAL REVIEW OF THE SCIENCE  
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LANGWORTHY, C. F. and HOLMES, A. D. in *Proceedings of the National Academy of Sciences of the United States of America*, vol 7, No 4, pp 110-123 Washington, April 1921

HYGIENE

The shortage in the World's food-supply in 1917 made the collection and correlation of data concerning human nutrition of the outmost importance and many questions were re-examined in the hope of providing additional data of value.

Extensive investigations into the chemical composition, digestibility and nutritive value of wheat and wheat products have already been made by European investigators and in the United States (1). Investigations made by the Office of Home Economics of the U. S. Department of Agriculture undertaken with the co-operation of the Maine and Minnesota Agricultural Experiment Stations included studies in the digestibility of wheat flours prepared in a variety of milling conditions from wheat grown in similar climatic, seasonal and soil conditions. The results obtained showed that the protein of white flour (72 % extraction) was 88.1 % digested; that of entire wheat flour (85 % extraction) was 81.9 % digested, and that of graham flour (100 % extraction) was 76.9 %.

In 1917, the U. S. Food Administration requested the Office of Home Economics to obtain additional data concerning the relative digestibility

(1) U. S. Department of Agriculture, Office Expt. Stations Bulletin 85 (1900); 101 (1901); 126 (1903); 143 (1904); 150 (1905)

of flours representing a series of extractions from the same lot of wheat. The flours studied were prepared from the wheat mixture provided to the flour-millers by the U. S. Grain Corporation late in 1917 and consisted of the following: choice hard spring (largely Marquis), 20 % — spring, 25 % — velvet chaff, 15 % — slightly smutty spring, 25 % — durum, 10 % — Kansas and Oklahoma, 5 %. The milling rates adopted were: 54-70-85-100 % of wheat or in other words the flours were those known in commerce as "patent", "standard patent", "whole wheat" and "graham". The digestibility tests were conducted with healthy young men, of whom some were accustomed to much and others to comparatively little exercise: There were 139 of these tests and the experimental periods were from 15 to 25 days in length and subdivided and regarded as separate and successive three-day experiments. The diet consisted of bread, oranges, sugar with tea or coffee. The following table summarizes the results.

*Summary of Experiments on the Digestibility of Wheat Flours.*

Kind of flour used	Number of experiments	Amount of bread eaten per man per day	Digestibility of entire ration			Digestibility of Bread Protein	Digestibility of Bread Carbohydrate
			Protein	Fat	Carbo- hydrate		
		Grammes	Per cent	Per cent	Per cent	Per cent	Per cent
54 % flour	43	600	87.8	96.5	98.8	87.7	99.7
70 % "	42	564	90.1	96.1	99.0	90.1	99.9
85 % "	21	472	87.1	96.9	97.5	87.1	98.5
100 % "	33	663	84.2	93.9	95.0	84.2	94.4

Thus the maximum of digestibility was shown by the 70 % flour, that of the 54 % flour was slightly greater than that of the 85 % flour, while the digestibility of the 100 % flour was the lowest. The results are in accord with those obtained in earlier experiments. The fat content of the diet was equally well digested, digestibility being almost complete, except in the case of the 100 % flour, when it reached 93.9 % only.

The 54 % and 70 % flours did not tend to produce constipation; the 85 % and 100 % flours produced a somewhat freer movement of the bowels but no marked laxative effect was noticed.

2 - The "Bacteriophagous" Microbe (1). - D'HERELLE, F., in *La Nature*, No. 2478, pp. 219-222. Paris, Oct. 1, 1921

An account, for general use, of the present state of information with regard to the bacteriophagus microbe discovered by the Author, who makes the following statement:

(1) Several Studies on the bacteriophagous microbe were analysed in R. April 1920, No. 439 and R. April 1921, No. 399. — Others have appeared in the *Comptes rendus de la Société de Biologie*, Vol. LXXXIV, 1921, pp. 3. (E. WOLLMAN). — 5 (L. MARTIN) — 275, 750, 751, 753, 755 (A. GRATIA) — 276, 278, 280, 745, 747, 748 (J. BORDET and M. CIUOA) — 339, 384, 538, 803, 908 (F. D'HERELLE) — 467, 468, 755 (J. MAISIN) — 708 (G. ELIAVA and F. POZERSKI) — (F. D'HERELLE and E. ELIAVA) — 847 (R. BRUYNOCHE and J. MAISIN). (*Ed.*)

" The facts observed in bacillary dysentery are the following

A sample of the dejecta are taken for each day from the onset of the malarly till the end of convalescence. Each sample is mixed with broth and passed through a Chamberland filter: all the microbes which can be seen under the microscope remain in the filter, the filtered liquid is clear and remains so indefinitely if preserved aseptically; it is apparently sterile.

For the sake of clearness, I take a chance example from the notes on a series of experiments

The case of Victor Ker was tested during a period of 30 days, giving 30 samples of dejecta filtrate, one for each day

Thirty tubes of dysentery bacillus culture are taken and a drop of each of the 30 filtrates added to each tube and all the tubes submitted to a temperature of 37° C in the stove. After twelve hours the following results are reached.

Tubes 1-6, no change; the broth is turbid as in the case of a normal culture of dysentery bacteria

Tubes 7-18, perfectly clear

Tubes 19-30, turbid as tubes 1-6

Hence a strange phenomenon is to be noted in tubes 7-18 the dysentery bacteria have been dissolved without leaving a trace. How has this been caused? It cannot be the drop of added filtrate. It is to be concluded that from the seventh to the eighteenth day the patient's dejecta contained some element which destroys and dissolves the dysentery bacteria.

If we now enquire whether there is any correlation between the state of the patient and the presence of the solvent principle in the excreta, we see that from the seventh day onwards the blood has disappeared from the stools and the patient's condition has rapidly improved, by the eighteenth day the cure was complete. The presence of the solvent principle has been coincident with the cure. An investigation of a large number of cases has shown that the phenomenon is constant, not only in bacillary dysentery but also in typhoid, fowl typhus and even in maladies without intestinal symptoms, such as hemorrhagic septicaemia in buffaloes and bubonic plague.

If the filtrate containing the principle which dissolves the dysentery bacteria is again examined and an infinitesimal quantity of the culture added instead of a drop - for example a thousand millionth part of a cubic centimetre, - after a few hours the bacilli are as completely dissolved as with a drop. What then is the nature of this bacteriocidal principle whose action is many thousand times more effective than any antiseptic, however powerful?

If a trace of the culture of dysentery bacilli which has become clear as a result of the action by the filtrate is taken and introduced into a new, very turbid culture of the same bacillus, within a few hours this second culture becomes clear and all the bacilli are dissolved. If a trace of this second dissolved culture is introduced into a third, this is in its turn dissolved also and the series can be continued indefinitely, for example a trace of the 100th dissolved culture causes dissolution in the 1000th. Hence the principle which dissolves the bacteria reproduces itself and develops as a living germ."

If the culture of dysentery bacilli in the limpid state is examined under the highest form of microscopic enlargement no microbe is visible. The principle which dissolves the bacteria is a microbe of extreme minuteness, which escapes the closest filtration and is invisible under the microscope, an ultra-microbe in a word. These ultra-microbes are enumerated in the following manner:

Ten cubic centimetres of a broth culture rich in dysenteric bacilli are taken to which is added the filtrate containing the dissolvent principle so diluted as to contain one fiftieth thousandth part of a cubic centi-

metre of the filtrate ; this is shaken vigorously and immediately a hundredth part of a cubic centimetre is exposed uniformly on the surface of a solid tube. After heating in the stove at a temperature of 37° C. a layer of bacilli will be found on the solid medium, interspersed with 50 small circular fields in which the bacilli are dissolved. Each field represents a focus for the dissolution of bacilli, that is to say an ultra-microbe originally developed. This method of enumeration is the basis of all the experiments which have enabled the Author to study the activities of the ultra-microbe and to determine its function.

The result so far obtained may be briefly summarized as follows :

The principle which dissolves the microbes is an extremely minute ultra-microbe : its volume might be regarded as equivalent to that of a molecule of albumen. It is named by the Author *Bacteriophagum intestinale* or more simply " bacteriophage " and is itself a dependent parasite only able to develop at the expense of living bacteria which it penetrates by means of its property of secreting dissolvent principles. It reproduces itself after penetration into a bacterium ; utilizing for its growth the substance dissolved from the bacterium, it forms a colony of 15 to 25 elements. The bacterium gradually swells, assumes a globular form and then bursts, thus liberating the young ultra-microbes, each of which in turn becomes parasitic on a fresh bacterium.

There is only a single type of bacteriophagous microbe, which through habituation can become parasitic for a very large number of species of bacteria, quite possibly for all bacteria. Up to the present the Author has identified it in parasitic stocks for very different species — the bacilli of dysentery, typhoid fever, plague and staphylococcus to name only typical bacteria of human diseases. The faculty possessed by the bacteriophagous microbe of becoming parasitic for different species of bacteria corresponds precisely with the acquisition of a " virulence " which can be enhanced or diminished *in vitro*.

The normal habitat of the bacteriophagous microbe is the intestine and the Author has found it in the contents of the intestine of all the healthy animals he has examined both vertebrate and invertebrate. Here it lives at the expense of the normal bacteria to be found in the host. When a strange bacterium is introduced into the intestine, the bacteriophagous microbe becomes habituated more or less rapidly according to conditions and becomes parasitical for the invading germ. If this germ is pathogenic, the fate of the individual attacked depends upon the rapidity with which the bacteriophagous microbe becomes habituated. If habituation is immediate, the disease aborts before producing any morbid symptom, if delayed, the disease declares itself and the period of delay determines the duration of the illness. Convalescence begins only at the moment when the bacteriophagous microbe gets the mastery of the bacterium and if habituation does not take place at all the victim succumbs.

The question arises why is habituation sometimes retarded or checked. The answer is that environment exercises an influence upon the struggle favourable to one or other of the contending germs. For exam-

ple the bacteriophagous ultra-microbe is more sensitive than the bacteria to the reaction of the environment ; it cannot resist a degree of alkalinity or acidity which the bacteria can withstand with practical impunity. There is also another element, primordial in character, which gives the other side of the question. The bacteriophagous microbe is capable of assuming the quality of " virulence " as against a bacterium, but the bacterium when attacked does not remain passive but defends itself and can acquire immunity. The stages of the struggle between the bacteriophagous microbe and the bacterium are precisely similar to the stages of the struggle between the bacterium and the higher organism on which it is parasitic. The disease bacterium secretes a toxin which acts upon the cells of the infected subject, which replies by developing an antitoxin. The bacteriophagous microbe secretes a dissolvent diastase, or lysine which acts upon the bacterium, which replies by developing an antily-sine ; thus there is merely a descent in the scale of the contending entities.

Protection by the bacteriophagous microbe is not confined to affections of the intestine ; the ultramicrobe can also enter the circulatory system and function at any point in the organism. For example the author in cases of convalescents has succeeded in isolating and making cultures of bacteriophagous microbe stocks which dissolve the bacillus of bubonic plague.

Briefly the history of a case of infectious disease is a reflection of the process of the struggle which takes place in the organism between a disease bacterium and the bacteriophagous ultra-microbe.

But this is not all : every convalescent from a contagious disease carries in the intestine bacteriophagous ultramicrobes working against the disease bacterium, and distributes them with his excreta. He can thus " infect " his neighbours and immunity is as contagious as the disease itself. The author has frequently discovered that at the end of an epidemic all susceptible subjects who have escaped the contagion carry in the intestine the bacteriophagous microbe in the active state and in this way the idea of " contamination " by the bacteriophagous microbe has been brought home to him.

Thus the history of an epidemic is in the final analysis the history of a struggle between two active forces : the disease microbe, which at the beginning develops freely, and the bacteriophagous microbe whose virulence against the bacterium increases in the case of patients where conditions are favourable. Such patients recover, distribute the bacteriophagous microbe in active condition and the epidemic comes to an end when all susceptible individuals give it shelter in their organism. These facts have been demonstrated by studies of different forms of animal distempers such as fowl typhus, hemorrhagic septicaemia of buffaloes and rat-plague : the two last diseases were investigated in the Far East.

Hence a new fact emerges : antimicrobial immunity is heterologous in the susceptible animal ; the defence of the organism is secured by an ultra-microbe, parasitical upon the bacteria.

But as has been seen this ultra-microbe can be cultivated *in vitro*

and it is therefore possible to obtain as many cultures as may be required. If the observations made are in fact accurate and a susceptible animal is assured of immunity from the moment when the bacteriophagous ultra-microbe becomes habituated to parasitism upon the disease-producing microbe which is trying to invade the organism, it ought to be possible to reproduce the phenomenon at will. In this case it will merely be necessary to introduce into the susceptible organism a culture of the bacteriophagous microbe which has become virulent for any particular bacterium to cause the organism to become immediately proof against the disease which it causes.

Experiments made in fowl typhus and hemorrhagic septicaemia of buffaloes have in fact established this principle, for they have shown that,—

a) in epidemic conditions a single injection of a minimum quantity of a culture of the bacteriophagous microbe active in relation to a given bacterium produced immunity from the disease caused by it from the moment of the injection.

b) in non epidemic conditions immunity was acquired only after an incubation period varying according to the dose injected. In the case of hemorrhagic septicaemia in the buffalo immunity is attained after twenty days with a dose of a quarter of a cubic centimetre. After the injection of a single drop a buffalo weighing 250 kg. became immune in four days.

Experiments in connection with the curative properties of the ultra-microbe have also been made on similar lines in 100 cases of fowl-typhus and later in 7 cases of human bacillary dysentery. These have proved that the injection or ingestion of a minimum quantity of a culture of the bacteriophagous microbe, developed at the expense of the disease-causing bacterium, checks the progress of the disease at once, provided of course, that it is introduced at a time sufficiently near to its first onset to secure that the organic lesions are not of themselves severe enough to bring about a fatal issue, for the function of the bacteriophagous microbe is confined to the destruction of the bacteria. It has been noted above that at the end of an epidemic all the susceptible individuals who have escaped contagion are carriers of the bacteriophagous microbe destructive to the bacterium which causes the disease. This conception makes it possible to consider the possibility of a collective protection. It would seem that this purpose would be fulfilled by diffusing in the drinking water cultures of the bacteriophagous microbe in a state of activity, there being ample experience to shew that it is absolutely harmless for all living beings.

In this way it could be made certain that the bacteriophagous microbe destructive of the cause of the epidemic would be present in the organism of all susceptible individuals during the whole of the critical period.

What light is thrown on the phenomenon of phagocytosis by these new facts?

A study of the phenomena of protection must deal with three different conditions of the subject :

- 1) The animal naturally resistant.
- 2) The susceptible animal that has acquired immunity either naturally following on an attack, or experimentally following a vaccine treatment.

The above are the two conditions which have been considered by **METCHNIKOFF** and his fellow workers. They have recognized that protection in these two cases is secured by phagocytosis. It still remains necessary to consider the means of protection for:—

- 3) The susceptible animal that does not, or does not as yet, enjoy immunity.

The two following questions require to be answered.

Susceptible animals exposed to contagion do not in all cases contract the disease. what are the means of protection possessed by those which escape?

An animal attacked by a contagious disease of bacterial origin is cured and thus obtains protection: what are its means of protection between the onset of the malady and the moment when this immunity is established? In fact why does the cure take place?

Experiments upon the bacteriophagous microbe suggest the answer to these questions.

The heterologous immunity produced by the bacteriophagous microbe does not take the place of the homologous cellular immunity, for it functions at a time when the latter is not active; the first is dominant in the susceptible animal, the second in the resistant.

**New Institutes for Agricultural Experiment in Italy.** — **STRINGHER, V.**, in *Atti della R. Accademia dei Georgofili*, Series V, vol. XVIII, N° 2, pp. 64-82. Florence, April 1921 (1).

AGRICULTURAL  
EXPERIMENTATION

An account of the establishment during recent years of Institutes for Agricultural Experiment, founded by various Agricultural Associations and placed under the general supervision of the Ministry of Agriculture.

The "Stazione agraria sperimentale" at Bari has been at work since 1919: its main objectives are as follows.

a) The scientific study of the special problems of Agriculture in Southern Italy with particular reference to the application of physics, chemistry and biology thereto

b) Methods of protecting crops from vegetable and animal pests.

c) The publication of practical information concerning crops and agricultural industries of special interest in Apulia.

The State, Province, Municipality and Chamber of Commerce of Bari all contribute to the maintenance of the Institute with a total annual contribution of 93 000 *lire*. The local authorities provided the building and site; in addition the Ministry of Agriculture made a grant of 640 000 *lire* for initial capital expenses.

(1) See R. Oct-Dec. 1919, No. 1074 (Ed).

The " Istituto sperimentale di meccanica agraria " at Milan was opened on June 10, 1920 ; its chief duties, which are both agricultural and industrial, are the following :

a) To carry out studies and trials of machines and machine-plant used in agriculture, agricultural industries, soil improvement and irrigation either at the instigation of the Government or other Public Administrative Bodies, the request of manufacturers, etc., or on the direct initiative of the Institute.

b) The preparation of tests and the collection and coordination of essential elements in trials for juries at Competitions and Exhibitions of agricultural machinery.

c) Laboratory and open air research work leading to conclusions likely to be of assistance in the scientific and technical development of machines and machine-plants for agricultural industries.

d) The coordination of the work of the Institute with results obtained in similar institutions in other countries, by juries at Competitions and Exhibitions and by specialists, with reports thereon to the competent Ministries and to Institutions and other bodies interested.

e) To give technical advice with regard to machines, plant and agricultural industries.

The Ministry of Agriculture has made a grant of 100 000 *lire* for initial capital expenditure and allows 50 000 *lire* a year for maintenance ; the Province and Municipality of Milan each make grants of 10 000 *lire* annually. It has however to be recognized that, in order to carry out its functions on the lines laid down, the Institute will require much larger subsidies and these are likely to be forthcoming.

A Government Decree of June 8, 1920, established the " Istituto nazionale di genetica per la cerealicoltura ". Its duties are to conduct experiments to discover the best varieties of cereals for the different districts of Italy and to arrange for their distribution to the farmers. The Institute will have a total sum of about 8 500 000 *lire* at its disposal.

The Institute will have under its administrative and technical control :

a) Phytotechnical stations with trial and initial multiplication plots for Apulia, Sicily and Latium (attached to the Institute) ;

b) Local observation and trial plots ;

c) Multiplication plots ;

d) Plots for the maintenance of pure seed lines with offices for distribution attached ;

e) A museum of genetics at Headquarters.

The technical work of the " R. Stazione sperimentale di granicoltura " at Rieti will be coordinated with that of the new Institute.

The " Istituto di allevamento vegetale per la cerealicoltura " was originally founded at the " Scuola superiore di Agraria " at Bologna and recognized by the Ministry of Agriculture on June 10, 1920, which assigned to it a total annual subsidy of 50 000 *lire*. The special duties of this Institute are as follows :



1) Work for the improvement of the most important types of cereals grown in Italy, particularly wheat and kindred varieties ;

2) To bring about a more effective and complete employment of improved varieties :

a) by encouraging and carrying out, in cooperation with local agricultural associations and individual farmers, trials for the purpose of delimiting the most advantageous zone of culture for each variety ;

b) by encouraging and directing as occasion arises the local seed production in each zone so that as a general rule each district may be in the position of raising on its own soil the means of reproducing the selected varieties which it requires ;

3) To carry out from time to time selective tests in an appropriate milieu, of common established varieties of cereals at the request, or on behalf, of a contributory agricultural association ;

4) To complete the phytotechnical studies of the pupils of the Higher Agricultural School of Bologna by means of an appropriate practical and experimental apprenticeship.

The " Stazione sperimentale di maiscoltura " was founded at Bergamo on March 7, 1920, for the purpose of the improvement of maize culture and is mainly engaged on the following studies :

a) The physiology of the maize plant ;

b) Native and foreign varieties, selection and crossing ;

c) The value of the main product (grain) from the point of view of preservation, crushing and grinding, as food for men and cattle, industrial use (cake, alcohol, etc.) and as a marketable commodity ;

d) The waste products (stalks, straw, etc.) and how to use them to best advantage ;

e) The rotation systems best adapted to the crop, fertilizers, preparation of the soil, sowing and methods of cultivation, irrigation ;

f) The main difficulties in maize-culture and methods of control ;

g) Means of preserving the crops, etc.

A capital expenditure of 240 000 *lire* has been incurred and maintenance subsidies amount to 35 000 *lire*.

The station will also be in a position to deal with problems of selection for other cereals and especially for barleys for malting, and in addition experimental work on deterioration in maize will be undertaken.

The " Stazione sperimentale di Riscoltura " at Vercelli was started in 1908, and reorganized in 1917. It derives an annual income of 39 600 *lire* in addition to the premises and land required for the special work undertaken which is as follows :

a) To initiate, encourage and control experiments and demonstrations with the object of improving rice culture on a scientific basis so as to increase the value of the crop both in quantity and quality and also to improve other irrigated crops grown in rotation with rice ;

b) To keep abreast of the economics of rice-culture both at home and abroad, as a source of information and guidance to be communicated to farmers and other workers concerned, for the benefit of Italian production ;

c) To make contributions to the solution of the hygienic and social problems connected with rice culture ;

d) To make known by means of suitable peripatetic instruction the results of experimental and demonstrational work.

Funds amounting to 3 800 000 *lire* have recently been made available for this station.

The Experimental Station which was started at Lodi in 1871 was developed in 1919 into the " Istituto sperimentale di Caseificio ". The main object of this Institute is to carry out scientific and technological enquiries into questions related to milk and its derivatives with reference both to its use as a food substance and also to the dairying industry in order to obtain precise and definite information. At the same time it will undertake experiments of all kinds calculated to establish the best technical results combined with the greatest economic advantages, and encourage the dissemination of modern ideas on the science and technique of milk production by means of occasional courses of instruction, conferences and publications. In addition to the half million *lire* allocated for capital expenditure, the Institute has a total annual subsidy of 50 000 *lire*.

The " Stazione sperimentale del freddo " annexed to the " R. Scuola superiore di Agricoltura " at Milan has been at work since July 1, 1913. Its functions include :

a) The examination, for purposes of comparison, of machinery, equipment and substances (especially non-conductive) used in the industry ;

b) The study of the application of artificial chilling, especially as regards the preservation of perishables and the treatment of agricultural produce ;

c) Enquiries into means of transport in cold storage and their organization from the point of view of food supply and problems of importation and exportation.

The Station has a total annual revenue of 18 000 *lire* together with a capital grant of 50 000 *lire* from the Ministry of Agriculture

The " Stazione di batteriologia agraria " at Crema was instituted in 1914 and deals with the following questions :

a) The preparation and preservation of forage ;

b) The feeding of cattle from the point of view both of hygiene and production ;

c) The milk industry ;

d) Tobacco culture ;

e) The retting of flax and other plants used in the textile industry ;

f) The preparation and preservation of alcoholic beverages ;

g) The preservation of fruits, vegetables and animal products ;

h) Treatment by organic fertilizers ;

i) Microbial soil life with reference to its productivity and chemical constituents.

The Government makes an annual grant for maintenance of 30 000 *lire* and a group of local and district agricultural Associations makes a similar contribution. As a result of the contributions by different State

Departments and local Associations the Station is now definitely established and is about to spend 800 000 to 900 000 *lire* on the purchase of a farm with stallage for 50 to 60 cattle.

The "Stazione sperimentale di pollicoltura" at Rovigo was opened on June 28, 1917. The land and buildings and certain grants are provided by the Local Authorities and in addition the State made a contribution of 40 000 *lire* for initial expenditure and allows an annual grant of 25 000 *lire*. The scope of this Institution includes :

a) The improvement of the most suitable breeds of birds, both local and imported, by means of crossing and selection ;

b) The comparative study and the choice of breeds giving the best results as regard food value and egg production ;

c) The study of the most scientific and economical methods of breeding ;

d) The study of the diseases of poultry and the best means of prevention and cure .

e) Instruction and propaganda by means of short courses at the Institute, conferences and practical leaflets.

f) All other forms of work and study, instructional and experimental, contributory to the economic development of poultry farming in Italy. Additional funds are to be allocated to the Institute by the Ministry of Agriculture

Adequate grants have also been made to the following — the Laboratories of Agricultural Chemistry at the R Scuola Superiore di Apicoltura at Milan and the R Scuola superiore di Agricoltura at Portici, the Laboratory of Chemical Agricultural Technology at the "R. Istituto Superiore agrario sperimentale" at Perugia, the Laboratory of Agricultural Chemistry at the "R Scuola superiore di agricoltura" at Pisa and the independent Laboratories at Forli and Udine.

In brief the Italian Government has, during the economic and financial crisis following on the war, made a liberal and comprehensive provision for Agricultural Experiment similar to that made when the first Institutes for experimental work in Agriculture were founded in Italy during the period from 1870 to 1872.

#### 4 - Third International Congress of Household Economy Instruction, Paris, April 1922.

The International Federation for the development of Domestic Economy Teaching, which has its central Office at Fribourg (Switzerland), decided to hold in Paris, from the 18th to the 21st of April a 3rd International Congress of Household Economy Instruction with an Exhibition of equipment, material and methods. The two previous Congresses were held at Fribourg in 1908 and at Ghent in 1913.

A National French Committee has been formed in Paris for the local organization of this Congress with M. CHAMPETIER DE RIBES as Chairman and an office at 23 Rue Bertrand.

The following are the subjects for discussion at the Congress.

EXHIBITIONS;  
MEETINGS,  
CONFERENCES

*General Scope:* Organization, science and means of simplification of household work.

**First Section.**

**GENERAL POSITION OF HOUSEHOLD ECONOMY INSTRUCTION.**

1) *Household Economy Instruction in different Countries since the Ghent Congress.*

A. *Position immediately before the war.*

B. *Position during the war.*

Increased activity of women in national life through replacing men called up for military service. Observations made under these headings.

a) How have Household Economy Schools been carried on and worked during the War?

b) Have they been subsidized by the State or Municipality?

c) How have Household Economy Schools adapted themselves to the special conditions and what special services have they rendered, both national and local?

d) How far have members of the staff assisted in making good the shortage in food and fuel during the war?

e) Have the respective Governments and Local Authorities appreciated the services rendered and in what form has appreciation been expressed? — General results — marked development of women's sphere in political, economic and social life.

C. *Position at present time.*

General reconstruction. — The part of woman and of Household Economy Instruction (from the point of view of the simplification of household work).

2) *Household Economy Instruction in the Primary School.*

How and when should Household Economy Instruction be given to girls in the Primary School?

Is any form of special equipment necessary for this Instruction in the Schools in which it is provided?

If so, what should it be for town and country schools respectively?

3) *Household Economy Instruction as an integral formative element in the education and instruction of young girls of all classes.*

Should Household Economy Instruction be compulsory in Girls' Secondary Schools?

How and when should Household Economy Instruction be given in Girls' Secondary Schools?

Should each School be specially equipped for this Instruction?

What should be the equipment for Town and Country Schools respectively?

Household Economy Instruction for boys.

4) *Correlation of Household Economy Instruction with home education.*

How to make parents appreciate the value of this Instruction?

5) *Correlation with Technical Education.*

- 6) *Professional Training for Household Economy Teaching.*
  - a) How should courses for the scientific training of Teachers of Household Economy be organized?
  - b) The importance of establishing a definite Teaching Service for Household Economy.
  - c) The Pedagogy of Household Science. Should the instruction be individual, in classes with definite lessons or under the general direction of the Teacher.
  - d) What should be the equipment for Household Economy Instruction in professional Training Colleges?
  - e) The careers and prospects of Students in Household Economy Training Colleges?
- 7) *Inspection of Household Economy Teaching. -- Duties of the Inspectorate.*

Second Section.

TECHNICAL INSTRUCTION IN HOUSEHOLD SCIENCE.

- 8) *Rural Household Economy Schools.*  
Ways and means of making Household Economy Instruction really effective in rural areas.
- 9) *Household Economy Instruction after the School age.*  
Civic duties of young girls -- Peripatetic Teaching. Child nurture.
- 10) *Technical training of domestic servants in the family (with compulsory examination).*  
Present trend in direction of professionalism.
- 11) *Inspection of Technical Instruction in Household Science.*

Third Section.

SCIENTIFIC QUESTIONS CONNECTED WITH HOUSEHOLD ECONOMY.

- 12) *Household Science at the University*  
Introduction of questions relating to Household Science into the research work in University laboratories.
- 13) *To what extent can Household Economy Schools assist in social betterment from the point of view of Working Class Housing, Food, Infant Hygiene, Cooperative Purchase and Consumption, High Prices and Adulteration?*

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The general notice of the Congress is accompanied by an extract from the *Bulletin of the Swiss Union of Technical and Household Economy Mistresses*, No. 4, Fribourg, April 15, 1921, setting out the resolutions of the Congresses at Fribourg (1908) and at Ghent (1913) and dealing with the main questions on the Agenda for the Paris Congress. This extract may be summarized as follows:

HOUSEHOLD ECONOMY INSTRUCTION IN GENERAL. — As regards the place of woman and of Household Economy Instruction (as making

for the simplification of household work) the School should lay stress on the main lines to be followed and on the detailed organization of the work, showing how the various small actions in each branch can be distinguished and arranged in orderly sequence.

*Household Economy Instruction in the Primary School.* — Pupils must have the requisite development of intelligence and adequate elementary instruction. Organization must be based on local requirements and the special needs of each group of pupils.

The pupil should be instructed in the keeping of household accounts ; in the country she should also be given a knowledge of the farm accounts which she will have to keep as mother of the family. At the same time she should have practice in making a ready reckoning of the net cost and nutritive value both of each dish and of each meal.

Household Economy work should not merely be grounded on knowledge derived from natural science courses, but practical household work should provide innumerable opportunities for the verification of scientific laws and incidental instruction in chemistry and physics.

Ideas on art should be suggested by the utensils, etc. in common use and the pupil taught to appreciate their beauty as well as the beauty of simple forms of ornament.

The equipment of a Household Economy School, whether in town or country, should as far as possible reproduce the home conditions of the majority of the pupils. The scheme of work and of the cookery course especially should be the main consideration. The school, even when in a town should give the pupil an idea of the economic and social importance of, the cultivation of flowers and vegetables, and for purposes of experiment and practical work there should be a garden attached.

*Household Economy Instruction as an integral formative element in the education and instruction of young girls of all classes.* -- Household Economy Instruction for persons above the School age should be given to girls who remain at school after the elementary school period (in secondary or higher schools, special and technical). It is a matter of importance that the subject should be included in the examinations which confer a certificate of capacity for Elementary School Teaching. It is desirable that it should be made a compulsory subject with such variations as the particular circumstances of each country may require.

*Correlation of Household Economy Instruction with home education.* — The home ought to assist the teaching by encouraging regular attendance and providing opportunities for the pupils to put into practice the lessons learnt at school. In order to popularize Household Economy Instruction Parents' meetings should be held and demonstration courses for working class women given. The Household Economy School should impart healthy ideas on the facts of life and inspire enthusiasm for simple tasks.

*Correlation with Technical Education.* — The geometric system (based on personal measurements) should be adopted in instruction in cutting out and dress-making.

*Professional Training for Household Economy Instruction.* — Instruction should be given only by a mistress trained in a special Training College. Admission to such a college should be confined to girls who have obtained the elementary School Teachers' certificate or its equivalent and the minimum duration of the course should be for a year. The course should include instruction in Science (physics, chemistry, natural history) limited to its application to household work and in so far as it tends to make the students discover the rationale of the various processes included in their work. Rudiments of medical knowledge (hygiene, physiology and practical medicine) should be taught simultaneously in connection with discussions on the chief bodily organs and their functions. The more general instruction should be given by the staff, certain branches, such as child nurture and hygiene (human and animal) being entrusted to specialists.

The following methods for providing the teachers with the means of improving their knowledge are suggested: conferences or study circles; repeater or special courses; technical libraries. Criticism lessons also serve a very useful purpose.

The instruction both theoretical and practical, should be in groups and at the end of the course an examination should be held. The house work should be carried out, entirely if possible, by the students in training with the help of children in the last two years of the elementary school, working in groups under the orders of the students responsible and the general direction of the Principal in charge of the Household Economy Instruction. All the housework of the school which has educative value (maintenance of cleanliness and order, orderly and tasteful arrangement of furniture, general control of the work and conduct of the children) should be entrusted to the students themselves and carried out by them under the strict and regular control of the teaching staff.

The Household Economy Teachers' Training College can be more or less agricultural in character according to the special needs of particular countries.

**TECHNICAL INSTRUCTION IN HOUSEHOLD ECONOMY.** — The Household Economy School can be expected to serve to some extent as a beneficial influence in connection with rural depopulation and rural problems in general by giving women a high conception of their function, both social and occupational, as heads of the farm household.

Continuation School work should meet the needs of *a)* young girls on leaving the Elementary School; *b)* wage-earning women such as domestic servants, factory and work-room hands, shop-girls, clerks, etc.

It is to be hoped that employers of labour will be willing to allow a Household Economy Class to be formed in their factories or workshops for the benefit of their young women workers or that at least they will grant full facilities to their young women workers and clerks to attend local classes.

Peripatetic courses should be given where it is not possible to have a permanent school.

**SCIENTIFIC QUESTIONS CONNECTED WITH HOUSEHOLD ECONOMY.** — Household Economy Schools can help in social betterment from the point

of view of Working Class Housing, Food, Infant Hygiene, Co-operative Purchase and Consumption, High Prices and Adulteration. The subjects of Instruction will include, rational feeding and vegetarian cookery ; the campaign against Alcoholism, Tuberculosis and Infant Mortality ; how to market ; social and charitable work.

Finally among resolutions of a general character is included one urging that in all countries where Household Economy Teaching is left to private initiative, there should be a federation of Committees, each preserving its own individuality, in order that the work and the benefits to be derived from it may enjoy the stimulus of concerted action.

## CROPS AND CULTIVATION

### AGRICULTURAL METEOROLOGY

- 5 - **Information Concerning the Amazon Region, Brazil.** — LE COINTE, P., in *Revista Commercial, Industrial e Agricola do Pará*, Year 10, No. 13, pp. 111-129, fig. 9. Belem (Pará), December 1920.

The immense basin of the Amazon, the typical region of *Hevea brasiliensis*, offers boundless sources of wealth to the planter and timber-merchant, but the adequate working of these vast forests depends upon two factors, a sufficient supply of labour and the skilled direction of experts in woodcraft. The colonisation of this territory is hindered by the climatic conditions, but their importance is often exaggerated. It must not be forgotten that the distribution of meteorological values differs considerably in the various sections of this vast region. Hence side by side with depopulated zones, where marsh fevers are rife, wide tracts of country are found which owing to the healthy climate are a pleasant dwelling-place even for the European settler.

The author gives an account of his study of the climate of the Amazon region, basing his remarks chiefly on data collected in the districts of Belem, Obidos and Manaos

TEMPERATURE OF THE AIR. — The thermometric observations naturally give very different results according to the localities where they have been made. It is however noticeable that, generally speaking owing to the slope of the Amazon basin towards the Atlantic coast, the East and North winds find their way unhindered into and sweep right through the valley, and the great evaporation they produce on coming into contact with the damp forest growth, largely tends to prevent any excessive rise in temperature ; on the lower Amazon, the average annual temperature is never above 28° C.

In the town of *Belem* (Pará), uninterrupted observations have been made at the Goeldi Museum for twelve and a half years ; similar meteorological work was done in 1897 at the Secretariat of Public Works and at the Lauro Sodré Institute ; the general average readings recorded (in centigrade degrees) were as follows : January, 25.9 — February, 25.3 — March, 25.9 — April, 25.9 — May, 26.1 — June, 26.3 — July, 26.4 — August, 26.3 — September, 26.6 — October, 26.8 — November, 26.8 — December, 26.4 — *annual average* 26.2.



The monthly means for 3 ½ years of observations in the town of *Obidos* (Pará), on the Amazon, about 900 km above Belem are as follows: January, 27.09. — February, 26.55 — March, 26.43 — April, 26.17 — May, 26.25 — June, 26.02 — July, 26.62 — August, 27.67 — September, 28.05 — October, 28.44 — November, 29.04 — December, 27.70 — *annual average* 27.17.

In the town of *Manaos* (Amazon) situated on the Rio Negro, a tributary of the Amazon 1574 km. above Belem, the thermometer readings are as follows: average annual temperature 26.8° C — maximum temperature (October 27, 1902) 37.5° C. — minimum temperature (April 28, 1902, 18.8° C — annual absolute deviation 18.7° C.

Thus, at any rate in the lower and middle valley, the weather is characterised by constant high temperatures with regular and slight variations. The variations, at Belem are in direct relation with the rainfall. In February which is the wettest month, the temperature is lowest, and November, the driest month, is also the hottest.

At Obidos and Manaos, the minimum temperature is registered in May-June, the thermometer falling through the influence of the "friagem", cold winds that rush down from the Andes. Here again however the greatest heat comes in November, the month of least rainfall.

As one leaves the river-banks and ascends the course of the tributaries, the heat decreases, and the difference between the day and the night temperature increases.

At 100 km. to the north of Obidos on the Ariraniba plateaux, at an altitude of 280 m., the heat is already tempered by the drier air and strong ventilation from the north-east. Further north again on ascending terrace by terrace, the great amphitheatre that rises perpendicularly from the river, the traveller finds a temperate climate in Brazilian Guiana, which with its fine natural pastures would offer every advantage to the colonist, were it not that the waterfalls interrupting the course of its rivers, and the total lack of roads, render all access to the country very difficult.

The upper part of the basin of the southern tributaries (Jurna, Purus, Madeira), is swept at certain times of the year (from March to June) by intermittent violent winds (southwest) coming from the Cordilleras which are still covered with snow. These winds are known as "Sur", or "Friagem", and produce a sudden fall in the temperature. According to the author, on the Madidi, a tributary of the river Beni (Upper Madeira), in Bolivia, the thermometer drops in a few hours from 38° C to 11° C. Owing to the sudden lowering of the temperature, the atmosphere becomes saturated with moisture and a thick fog obscures the sun and extends over the district. The "Friagem" wind arises on calm hot days, shortly after the sun has passed the meridian, and is preceded by a fall of the barometer (5 to 6 mm.). The wind blows for 3 to 8 days.

The effects of the Friagem can be felt though to a very limited extent as far as Ovidos and Manaos.

TEMPERATURE OF THE SOIL. — At Belem the soil temperature, at 1 metre below the surface, varies from 26° C. to 28.5° C. From observa-

tions made at the Lauro Sodré Institute (from 1904-1907), the annual average temperature is 27.45° C. At a depth of 30 cm. the average is 27.90° C.

**RAINFALL AND FOGS.** — The changes of temperature are not sufficiently marked to make it possible to divide the year into seasons. There are however two distinct periods, the rainy and the dry. The North-East Trade Winds passing over vast ocean tracts heated by the tropical sun, carry periodically into the basin of the Amazon enormous masses of water-vapour which ascend the valleys as far as the eastern ramparts of the Corderillas.

The sky is rarely clear, being usually greyish-blue and the horizon is veiled by thick fogs. The average nebulosity is 5.35 at Obidos, 6.3 at Manaos and 5.3 at Belem. In the latter town, it is 6.9 during the rainy season (January-April) and 3.6 during the dry (August to November).

At Belem, the so called dry period is only relatively dry for more or less rain falls throughout the year according to the seasons. The rains begin at the end of December, and attain their maximum from January to April; the winter, as the rainy season is called, finishes in August. The driest summer months are September, October and November.

All the country to the east of Gurupa, which includes the "furos" district, the great part of the "island" zone, the south and south east of Marajo and the right bank of the Pará as far as the coast, have the general climatic conditions of the Tocantin zone though slightly modified by the vicinity of the ocean.

From the observations made from 1894 to 1911, at the Museum, at Belem, the rainfall in that town is distributed as shown by Table I.

TABLE I. — *Rainfall Distribution at Belem from 1894 to 1911.*

January	296 mm	27 wet days
February	360 "	26 " "
March	388 "	28 " "
April	370 "	26 " "
May	261 "	24 " "
June	195 "	22 " "
July	166 "	19 " "
August	119 "	16 " "
September	87 "	16 " "
October	80 "	15 " "
November	64 "	13 " "
December	150 "	20 " "
Totals	2 486 mm.	252 wet days

The relative humidity of the air is always very high; the 10 years' average being: January, 92.3 — February, 93.08 — March, 92.5 — April, 91.5 — May, 89.1 — June 86.1 — July, 86.1 — August, 86.1 — September, 85.2 — October, 84.2 — November, 85 — December, 87.6 — *Annual average* 88.3.

TABLE II. — *Rainfall Distribution at Obidos.*

	Amount in mm.	Wet days	Relative humidity
January. . . . .	124.3	21.8	80.76
February . . . . .	173.2	20.2	81.25
March . . . . .	316.9	21.6	84.74
April . . . . .	225	23	85.34
May . . . . .	155.1	18.6	83.69
June . . . . .	93.8	12.6	79.33
July . . . . .	49.3	7	73.66
August . . . . .	14.4	4.5	69.26
September. . . . .	63	5.5	70.80
October . . . . .	67.5	5	65.00
November . . . . .	77	5.2	62.49
December. . . . .	113.3	12.7	78.77
<i>Totals . . . . .</i>	<b>1592.3</b>	<b>157.1</b>	<b>76.26</b>

At Macapá on the northern bank of the estuary of the Amazon, the rainy season, which lasts for 8 months is clearly marked off from the dry season lasting for 4 months during which almost absolute drought prevails.

The same division of the year is met with on ascending the lower course of the great river, but the rainy season is reduced to 6 months and the amount of rainfall is correspondingly diminished. Table II gives the results of the observations made at Obidos during 4 ½ years.

On the lower course of the Amazon, the North-east wind ("vento geral"), brings the dry weather and the west and the south-west wind ("vento de cima"), bring the rain.

At Manaus almost the same conditions are to be observed as at Obidos. The averages for five years are given in Table III.

Travelling from Manaus towards the interior of the basin the relative humidity is observed to increase, until the saturation point is reached, and condensation takes place owing to the countless streams, lakes and swamps that cover this region. At Porto Velho on the river Madeira, the rainfall already amounts to 2640 mm., distributed as follows: January, 373.8. — February, 338.8 — March, 330.2 — April, 255 — May, 139.2 — June, 52.8 — July, 17.8 — August, 34 — September, 142.2 — October, 240 — November, 328.1 — December, 386.8.

On ascending the course of the Purus, the climate becomes continually damper and the rainfall increases; the amount of water falling annually at Tefé is already double that falling at Obidos; at Pebas, the rainy season lasts nearly the whole year. From this point however the rainfall continues to diminish, at Iquitos (Peru), the average temperature is 4.8, the relative humidity 83, and the total rainfall 2840 mm.; August is the driest month. Finally Cordillera de los Andes, the Western boundary of the basin is reached; there the large masses of water vapour which pass up the great river valley from the Atlantic Ocean are condensed in the form of the rain that incessantly beats upon the eastern slopes of the mountain chain and the snows that cover its lofty summits. This condensation is so complete, that almost absolute dryness prevails on the other side of the crest on the Pacific slope.

*Other Meteorological Phenomena.* — In spite of the excessive humidity, fogs are somewhat rare owing to the constantly high temperatures; they are however occasionally to be seen in the early morning in April and May. Little dew falls on the deforested land of the lower reaches of the river, but heavy dews are common in the interior of the country. Violent hurricanes and sudden gusts of wind are of rare occurrence. The atmospheric pressure like the temperature is subject to slight and regular variations; it attains its maximum in the morning and diminishes progressively during the day.

TABLE III. — *Distribution of Rainfall at Manaos.*

	Amount in mm.	Wet days	Relative humidity
January . . . . .	240	22.7	82
February . . . . .	248	20	81
March . . . . .	290	19.6	83
April . . . . .	202	15.6	82
May . . . . .	135	14.6	82
June . . . . .	43	4	77
July . . . . .	89	4.6	76
August . . . . .	51	4.3	74
September . . . . .	38	7	73
October . . . . .	45	12.3	72
November . . . . .	30	10.3	71
December . . . . .	225	19.3	78
Totals	1 657	151.3	77.6

The degree to which the Amazon climate is healthy depends largely upon all the factors discussed above and varies considerably in different parts of the immense region. The climate is distinctly unhealthy in the interior, but continues to improve in the riverine zone of the middle and lower portion of the great river (1).

#### 6 - Influence of Climate on the Fixity of Hybrids from the Standpoint of the Segregation of Characters in the Second Generation. — See No. 26 of this Review

(1) On the other hand, the progressive draining of the interior (sertão) and systematic cultivation will gradually bring about the disappearance of the swamps and in consequence greatly increase the salubrity of the region. As Dr. Deodécio DE CAMPOS, Delegate of Brazil at the International Institute, has informed us, the district of Belem -- in the low-lying district of the estuary of the Para -- now enjoys a very healthy climate, owing to the drainage operations that have been carried out and to the energy of the special Sanitary Service (directed by Professor Osvaldo CRUZ), which has completely freed the town from mosquitoes. (*Ed.*)

7 - **Researches on the Specific Gravity of Certain Soil Constituents from the Point of View of the Fineness of the Soil Particles.** — NOLTE, O. (Landwirtschaftliche Versuchsstation zu Braunschweig), in *Internationale Mitteilungen zur Bodenkunde*, Vol. XI, Parts 3-4, pp. 117-118. Berlin, 1921.

SOIL PHYSICS

In theory it might be expected that the finer a body is, the less should be its specific gravity and this has again been proved by the author as regards certain typical soil constituents. He determined, with the help of a pycnometer, at 17-19° C, the specific gravity of fractions separated by mechanical analysis, estimating their density when air-dried at 100° C, and calcined, as compared with the specific gravity of water at 4° C. By this means as regards the precipitated silicic acid and kaolin, perceptible differences were found between the specific gravity of the fraction that was precipitated in less than 24 hours, and the fraction deposited subsequently; these differences showed themselves at the 2nd and even the 1st decimal place. On the other hand, in determining the chemical composition of fractions of a stiff clay deposited in 24 hours and after this time had elapsed, it was found that not only some of the colloidal portion remained in suspension, but also that there were great differences in their composition; thus the silica fell from 56.45 to 53.2 and 53.1%; the alumina rose from 37.26 to 40.9 and 42.0%; and the sesquioxide of iron from 1.84 to 2.3 and 2.5%, the amount of lime, magnesium, and sodium varied; on the other hand, the potassium content increased considerably, from 0.24 to 0.8 and 1.2%; oxide of titanium was only present in the intermediate fraction. The variation of the specific gravity of the portions obtained by means of more fractional deposition is characteristic, as is seen from the following Table:

Specific Gravity	Fraction precipitated				
	Before 100 seconds	After 100 seconds	After 15 min	After 2 hours	After 24 hours
Expressed in relation to air dried material . . . . .	2.467	2.470	2.492	2.482	2.317
Expressed in relation to mat- erial dried at 100° C . . . .	2.026	2.615	2.640	2.638	2.497
Expressed in relation to calc- ined material . . . . .	3.317	3.115	3.017	3.048	3.008

This shows, that there is a considerable difference between the finer particles and the coarser ones, which do not vary perceptibly.

8 - **Effect of Temperature Upon the Absorbent Properties of Soils.** — STOQUER, in *Comptes rendus de l'Académie des Sciences*, Vol. 173, No. 17, pp. 731-733. Paris, October 24, 1921.

Agricultural soils experience great variations of temperature. In the neighbourhood of Paris the difference between the monthly averages of the same soil in July and January has been found to amount to 24.4° C

at the surface and to  $19.3^{\circ}\text{C}$  at a depth of 0.25 m. (FLAMMARION). DE GASPARIN found a difference of  $3^{\circ}\text{C}$  at Orange.

The author wished to ascertain whether such variations had any effect upon the soil's power of fixing certain fertilising substances. He selected 4 soils differing in composition and studied their capability of absorbing sulphate of ammonium at  $0^{\circ}\text{C}$ ,  $16^{\circ}\text{C}$ ,  $35^{\circ}\text{C}$  and  $55^{\circ}\text{C}$ .

The experiment was carried out as follows: an amount of soil equivalent in weight to 100 gm. of dry soil was introduced into a flask, together with a total volume of 250 cc. of a very diluted solution of ammonium sulphate. The flask, which was kept in a bath at a constant temperature, was well shaken at the beginning and was afterwards shaken every 15 minutes for 1 hour. In order to clarify the solution, the flasks were left for 3 hours in the bath at the same temperature. A portion of the clear liquid was decanted and the ammonium present determined by distillation in the presence of magnesium. From the result obtained, the amount of ammonium fixed by the soil is estimated.

The total results are given in a Table from the study of which the following conclusions can be drawn:

1) The absorbent power always increased with the concentration of the solutions. This confirms an already well-known fact.

2) Under the conditions of the experiment, the absorbent power was sometimes negative (that is to say, the soil gave up some of the ammonium to the solution), or even sank to zero (when the solution contained the same amount of ammonia as the given soils). This occurred, within the limits of the temperatures studied, in the case of the first three soils with a 0.02/1000 solution, and in the fourth (garden mould), with a 0.08/1000 solution.

3) All the soils gave up ammonium to the distilled water (as was to be expected), and the amount yielded increased as the temperatures rose.

4) The absorbent power of the soil, as regards sulphate of ammonium decreased when the temperature was raised.

5) At temperatures that easily occur in soils, some are able to yield up their ammonium to 0.02/1000 and stronger solutions. These soils are not very poor in ammonium, and may have received a dressing of ammoniacal fertilisers. In certain circumstances, the amount of ammonium removed from the soil (without even being converted into nitrate), by the percolating rain-water is perhaps larger than is generally supposed.

The opinion is gradually gaining ground that soil solutions, in spite of their low content in fertilising substances, exercise a great influence upon plant nutrition. These solutions, as is seen from what has already been said, are richest in ammonium at the warmest periods, which is just when plant growth is most active; hence we may suppose that some correlation exists between the two phenomena.

9 - **Relation between the Nitrogen Content of the Soil and the Yield of Indigo in India.** — See No. 50 of this Review.

10 - "Taungya" Cultivation in the Shan States, Burma, and Methods of Soil Treatment Recommended. — THOMPSTONE, E. (Deputy Director of Agriculture, Burma), in *The Agricultural Journal of India*, Vol. XVI, and Pt. 3, pp. 251-264, Pt. 4, p. 396-405. Calcutta, May-June 1921.

The "taungya" system of cultivation as practised in the Shan States, Burma, and elsewhere, has been the subject of official investigation for many years, chiefly on account of the enormous amount of damage done to forest areas and the heavy destructions of timber. The system includes the cutting down of the jungle growing on the hillside, lopping off any branches of the trees and heaping these up with the brushwood, etc. round the stumps and then firing the whole. This operation takes place during the dry weather (February to May). Subsequent cultivation depends upon the slope of the ground and often the use of a hoe is the only implement possible on the steep hillside.

After burning, the heaps are allowed to cool and if the crop grown is potatoes, the setts are planted in mounds from 1 to 3 setts in each; for other crops the heaps are spread by hand and the seed is sown broadcast. The principal crops grown in the Myelat are paddy and potatoes with an occasional crop of sesamum. Other crops grown are maize, ginger, ground-nuts, sweet potatoes, gourds, opium, cotton and several kinds of beans.

The land is cultivated from 1 to 3 years (rarely 4) and then allowed to lie fallow for a considerable period. The actual "taungya" process is varied somewhat according to locality, conditions of fuel supply, etc.

The cultivator often attributes the success of his "taungya" crop to the destruction by fire of insects and fungi, and his failure after 2 or 3 years, to the return of these pests. However, investigations have shown that the probable effect produced can be traced as follows: — The young crop first makes use of the ammonia directly produced by the heat and later of that produced by the increasing number of bacteria. This continues till the crop is harvested, after which the production of ammonia is lessened by its accumulation (which checks the activities of the bacteria) in the soil, and later by the drying of the soil which will eventually arrest the process and check the multiplication of both classes of micro-organisms for the period of the dry season. At the break of the second rains the soil bacteria still retain the upper hand, but before the season's crop has been harvested the destructive organisms are rapidly gaining ascendancy, and before the dry season again comes round, the increase is marked, at the expense of bacteria. Once the original state of equilibrium is fully established between the two classes of organisms, the effect of the burning will have disappeared and the soil will have returned to its previous natural state, which on account of its poverty in lime and organic matter will entail unprofitable crop production over very large areas.

The results of practical field experiments strongly support this theory, and the ultimate aim of all "taungya" investigations has been to bring land under permanent cultivation, to put a stop to this destructive method and thus to induce the people to settle down on holdings of reasonable size with consequent substantial benefit to the country.

Results obtained at Yawnghive and Hsumhsai (Burma) suggest a simple and practical solution of the problem and the author here describes in detail a few typical cases.

There are obviously two ready substitutes for the heat (1) now being so laboriously applied, viz. lime and organic manures, small dressings of either have given more productive results and seem to be more lasting in their power than an ordinary "taungya" burning. The following examples demonstrate this fact:— The average increase in wheat yield on land to which lime was applied at the rate of 6000 lb. per acre, amounted to 273 lb. per acre (120 %) on land that had been cultivated for one year without previous burning, and an increase of 3440 lb. per acre of maize is reported on old "taungya" land. Corresponding results were obtained with *Phaseolus lunatus*, *P. calcaratus*, *Cajanus indicus*, *Cicer arietinum*, *Polygonum Fagopyrum*, etc.

As regards organic manure, in every case so far tried, the benefit derived from unburnt manure proved to be greater than that brought about by burning an equal quantity of manure. The following figures show also the advantage of planting potatoes in drills.

	Yield of tubers lb. per acre	Yield of grain lb. per acre
1919-20. In drills . . . Manure unburnt	9620	1200
" " . . . Manure burnt . .	6960	900
" " . . . No manure . . .	2800	nil
Hill method. . Manure unburnt	4000	—
" " . . Manure burnt . .	3540	—

These results were obtained without the aid of lime, but a combination of lime and manure gave also very striking results. (Lime had been applied 2 years previously, 5000 lb. per acre).

	Yield of potato tubers lb. per acre	Yield of grain lb. per acre
Manure and lime . . . . .	8780	1960
" (without lime) . . . . .	6160	520

Some of the older plots that have so far received neither lime nor manure have however still maintained their yields by good cultivation and rotations, and leguminous crops have been grown with success.

The author considers that liming, manuring and good cultivation, combined with a proper system of rotation can make continuous cultivation

(1) See R Jan 1913, No. 14, and R. June 1913, No 616. (Ed.)



much more profitable than the present methods of shifting from place to place. The natural advantages for agriculture and the evident future possibilities for the Shan States make the need for experimentation extremely important.

II — **Experiments in Liming in the United States and in Canada.** — I HARTWELL, B. L., *Liming with High-Magnesium Versus High-Calcium Limes*, in *Agricultural Experiment Station of the Rhodes Island State College, Bulletin 186*, pp. 19. Kingston, R. I., May 1921. — II. MCCALL, A. G., *The Comparative Value of Different Forms of Lime*, in *The University of Maryland Agricultural Experiment Station Bulletin 242*, pp. 157-166. College Park, M. D., January 1921. — III SHUTT F. S. (Dominion Chemist), *Lime in Agriculture*, in *Dominion of Canada, Department of Agriculture, Dominion Experimental Farms, Division of Chemistry, Bulletin 80*, pp. 16, revised. Ottawa, Ont., May 1921.

MANURES  
AND  
MANURING

I. — Experiments to determine the liming effects of high calcium and high magnesium limestones, as well as of their burned and hydrated products.

The tests were carried out on permanent experiment plots of silt loam which were ploughed in 1893, and cropped with maize until 1899, after which various crops were grown till 1909, when the present experiments were begun. No lime, manure or fertiliser had been previously used. The first application of lime was made in 1909-1910, the amount used being sufficient to neutralise the same quantity of acid. The second and third applications of lime were made in 1914 and 1916. The latter completed the neutralisation of the soil acidity when, judging from the influence of the carbonated water, the speed of reaction of the limes would decrease in the following order: Magnesian hydrate, calcic hydrate, calcic limestone, magnesian limestone. From 1909 to 1921, the crops were mixed; hay, maize, potatoes, etc. No farm manures were used, but chemical fertilisers were usually applied so liberally that the liming materials were expected to act as neutralisers only and not as sources of plant food.

Beginning in 1917 the proportion of magnesium to calcium was increased by using in the mixture low-grade sulphate of potash and double superphosphate.

In 1920 the ratio of magnesium oxide to calcium oxide extracted from the soil by carbonated water was about  $\frac{1}{7}$  from the plots receiving the calcic limes;  $\frac{1}{1.7}$  from those receiving the magnesian limes, and  $\frac{1}{2.2}$  from the unlimed plot. The yields were equally satisfactory whether the ratio was  $\frac{1}{7}$  or  $\frac{1}{1.7}$ . In 1917 the ratio of magnesium oxide to calcium oxide in dried endive was respectively  $\frac{1}{1.1}$  to  $\frac{1}{1.5}$  with the plots that had received magnesian hydrate and limestone; from  $\frac{1}{2.2}$  to  $\frac{1}{3}$  in the case of the plots given calcic hydrate and limestone, and  $\frac{1}{2.8}$  in the control plot without lime.

The humus content and loss on ignition indicate slightly less organic matter in the soil to which the hydrates instead of the limestones had been added. It can scarcely be concluded with certainty that the different limes have been accompanied by a change in the nitrogen content of the limed soil as compared with that of the unlimed soil, although the percentage of nitrogen is slightly higher where magnesian limestone was used. The unlimed plot was decidedly acid as compared with the limed plots, but it was the only one from which aluminium was extractable by certain normal salt solutions, and by carbonated water.

Certain sensitive crops have been greatly benefited by the liming; the beet yield for instance was frequently increased sixfold. Even these crops did not however react to the liming in such a way as to warrant generalisations concerning the specific effects of the different kinds of lime. Practically like effects may be generally expected whichever of the four forms is used, from an application having a given neutralising equivalent, that is, based upon the percentage of magnesium oxide multiplied by 1.4, plus the percentage of calcium oxide, provided that the limestones are sufficiently fine to pass through an 80-mesh sieve, and that the hydrates are used with the ordinary precautions.

II. — Lime is the key to soil fertility building, since the economic use of both manure and commercial fertilisers is dependent upon the lime supply of the soil.

The author tested the value of several lime-bearing materials in 3 different parts of the State. In one case, he compared the effect of : 1) burnt lime ; 2) burnt oyster-shell ; 3) shell marl ; 4) pulverised raw shell. The shell marl gave the highest yield of wheat and hay while the pulverised shell produced almost as much wheat and hay and a larger amount of maize. It should be mentioned that the marl contained nearly 3 % of potash which may account for its superiority.

In another experiment, a comparison was made between the effects of pulverised raw oyster shell, burnt oyster shell, pulverised raw limestone and burnt limestone ; the total average increase on the two plots during seven years as compared with the control plot, expressed in dollars per acre was 78.43 for the pulverised oyster shell, 73.85 for the burnt oyster-shell, 77.60 for the pulverised raw limestone, and 77.05 for the burnt limestone ; thus the differences between the effects of the various forms of lime used are negligible. In another experiment with lucerne, it was found, that raw pulverised limestone gave better results than raw oyster-shell lime, burnt limestone and hydrated lime.

In conclusion, the author advises agriculturists to determine whether their soils need lime and the amount required.

III. — The practice of liming has been sometimes encouraged and at other times discountenanced, which shows that if lime must be used it should be applied in moderation. The author described the experiments made of recent years by the Chemical Division of the Organisation of the Experiment Farms of East Canada. These have proved that in many

places, the yield has been increased by liming, especially in the case of clovers which form the basis of profitable agriculture.

In one experiment on clayey-sand the application of 672 kg. of potassic fertiliser per hectare which supplied 22.4 kg. of nitrogen, 44.8 of phosphoric acid, and 56 kg. of potash, and was spread before oats were planted, produced in 1914, 51.57 hectolitres of grain per hectare. Another plot treated in the same manner, but to which 2240 kg. of ground limestone was applied, produced 59.58 hectolitres per hectare (or 8 hectolitres more than the first plot). The second year of the rotation, the unlimed plot bore 55.5 quintals of clover and timothy-grass hay, whereas the limed plot yielded 83.8 quintals or 28.3 quintals more.

In another experiment two series of parallel plots on soil similar to the preceding, were dressed at the beginning of each rotation in the autumn with 50.2 quintals of ground limestone, and in the following spring each of the series was given a different manure. In 1919, two three-year rotations of potatoes, cereals and clover gave the final results set forth in the following Table.

Leaving out of account the evident effect of the dung, these data show that the lime stimulated the action of the fertilisers and their residues in each three-year rotation. The effect of ground limestone is especially noticeable in the case of grasses particularly where basic slag was applied.

*Average Yield per Hectare.*

1st Rotation (1914-16)	Potatoes 1914 hectolitres	Oats 1915		Hay 1916 quintals
		Grain	Straw	
		hectolitres	quintals	
Control . . . . .	50.31	27.36	18.1	8.06
Limestone alone . . . .	60.84	29.52	18.7	12.43
Chemical fertilisers alone . .	76.02	28.53	20.4	7.39
Fertilisers and limestone . .	86.04	34.56	24.6	16.73
IInd Rotation (1917-19)	Potatoes 1917 hectolitres	Wheat 1918		Hay 1919 quintals
		Grain	Straw	
		hectolitres	quintals	
Dung alone . . . . .	226.62	17.55	22.2	29.57
Dung and limestone . . . .	282.06	26.82	25.3	45.81
Dung and chemical fertiliser	263.16	20.93	22.4	33.01
Dung, fertiliser and limestone	296.37	27.18	29.4	55.17

In an experiment on sandy soil, where a comparison was made between unlimed plots and others to which 5 tons of limestone per hectare had been applied, the average yield of seed per hectare was for 3 varieties of barley 10.58 and 43.68 respectively — for 5 varieties of oats, 100.12 and 113.57 — for 4 varieties of wheat, 36.12 and 46.04 — for 4 varieties of peas, 39.14 and 79.30.

In Canada, some of the commonest calcareous substances are marl,

or shell-marl, with a lime content varying from 30 to 90 %. The author advises the application of from 5 to 12.5 tons of dry marl for light and clay-sandy soils, and of 25 to 75 tons for heavy clays. The land should be ploughed and harrowed both in the spring and autumn. If marl is to be obtained, there is no need to get ground limestone or lime, for marl is cheap, improves the soil greatly and increases the yield.

This Bulletin concludes with a series of analyses of the calcareous substances suitable for agricultural use that are to be procured in the different provinces of Canada.

**12 - The Present Condition of the Superphosphate Industry in Japan.** — ISHIKAWA I., in *Kōgyō-Kuagata Zasshi* Vol. XXIV, No. 7, pp. 700-717, figs. 5. Tokyo, July 1921.

In Japan, the greater part of the people are engaged in farming, and the capital invested in agriculture is three or four times higher than in the manufacturing industries. The area of land cultivated for 2 000 years is as follows :

Rice-fields . . . . .	3 010 000 <i>chobu</i>
Under other crops . . . . .	3 070 000 "

1 *chobu* = about 2.45 acres).

The rate of increase in population amounts annually to 1.0 per cent. while that of rice-fields, and other fields under cultivation is only 0.4 per cent. in each case. Therefore, if Japan does not make efforts to intensify production by using chemical fertilizers, the food problem will become serious.

The fertilizers used are bean cake, rape cake, cotton-seed cake, pressed herring, pressed sardine, bone meal, Chili nitrate, ammonia sulphate, superphosphate and mixed fertilizers. In 1919, the total cost of these fertilizers (with the exception of Chili nitrate) was estimated at 240 000 000 *yen* (1 *yen* = about 2 shillings at par), of which 10 % was superphosphate and 60 % bean cake.

The present condition of the superphosphate manufacturing industry is as follows :

Number of companies . . . . .	15
Number of factories . . . . .	28
Productive capacity . . . . .	25 000 000 <i>yen</i>
Nominal capital . . . . .	72 000 000 "
Capital paid . . . . .	53 000 000 "
Current capital . . . . .	111 000 000 "
Permanent investment account . . . . .	28 000 000 "

The number of sulphuric acid plants, which are closely connected with the superphosphate industry, is 53 and most of them are in the Tokio and Osaka districts.

In 1888 the first artificial fertilizer company in Japan was established. Since the China-Japanese and Russo-Japanese wars, as a result of the prosperous conditions of the market, new companies were established. When trade became dull, amalgamation took place, so that the present companies rest on a stable basis and are reliable.

The demand for mineral phosphate is 300 000 tons yearly, while the home production is chiefly from Rasa Island ; but its maximum production amounting to 110 000 tons per annum only, Japan must continue to import the raw material. Angaur Island has lately come into the possession of Japan and it will somewhat neutralize this disadvantage ; its reserve, however, is said to be only 2 000 000 or 3 000 000 tons. Probably more mineral phosphate will be supplied from the province of Kiangsu (China), and from Hirata Island, south of Hainan Island.

As to sulphuric acid, there are 124 lead chamber and tower system plants and 8 plants employing the contact process. The total capacity for production is estimated at 1 150 000 tons of 50° B $\acute{e}$ . acid per annum, the actual amount being 900 000—950 000 tons, 500 000—550 000 tons of which are used to produce superphosphate.

In Japan, superphosphate is mainly packed in straw bags, even though a small amount of burlap bags is used. The straw bags are mostly made by hand as farmers' by-products and the old bags are re-used by them for many purposes. Therefore packing by machine is not, for the time being, considered desirable. The present production of superphosphate amounts to 15 000 000 bags (1 bag contains about 83.3 lbs.) per annum, and if the time comes when more superphosphate is used for every area unit, e. g., 10 bags per 1 chobu, 30 000 000 bags will be required in Japan. Moreover, China is thickly populated and does not at present use any artificial fertilizer (1). When it does come into use in China large quantities can be supplied from Japan. Consequently there are limitless prospects for the superphosphate industry in Japan.

13 - **Relation of Organic Matter and the Feeding Power of Plants to the Utilisation of Rock Phosphate.** — BAUER, F. C., (Agricultural Experiment Station, University of Wisconsin), in *Soil Science*, Vol. XII, No. 1, pp. 21-39, tables 9, bibliography of 45 works. Baltimore, M. D., July 1921

The processes accompanying the decomposition and the feeding power of plants are undoubtedly important factors in the utilisation of rock phosphate. Experiments were planned in which common forms of organic matter were used with rock phosphate and in some cases provision was made for the removal of the soluble phosphorus and calcium in order more nearly to imitate field conditions in this respect. The soil medium consisted of either sand or soil, the former contained no soluble phosphorus. Experiments were made as follows : a) rock phosphate mixed with several forms of organic matter in sandy soil with no provision for the removal of phosphorus as it became soluble ; b) in similar mixtures provision was made by leaching and c) by upward moving capillary water, both for the removal of phosphorus as it became soluble ; d) study of the solvent effect of organic matter extracts with and without carbon dioxide on rock phosphate ; e) pot culture experiments, also made to ascertain this effect and to test the feeding powers of plants in relation to the utilisation of rock phosphate and felspar. The results may be summarised as follows :—

(1) See R. Sept. 1920, No. 880. (Ed.)

1) Experiments (a) (b) (c) and (d) failed to show a solvent effect of the decaying matter on rock phosphate, and in confirmation of results obtained by other investigators there was evidently a gradual decrease in the amount of soluble phosphate. The failure of the experiments to show an increase in the availability of rock phosphate was probably due to the fact that when organic matter such as was used (in this case, finely pulverised air dry buckwheat hay, sweet clover hay, alfalfa hay, soybean hay, mammoth clover hay, maize stalks, oat straw and chopped green buckwheat and sweet clover) decomposes, sufficient bases are liberated along with the acids that are formed, to neutralise the acids and prevent their action on rock phosphate. When mixtures of rock phosphate and organic matter are applied to soils, the conditions are different because of the capacity of soils to take up basic material, especially if they are acid.

In some cases mixtures of organic matter and rock phosphate applied in pot cultures produced increase in growth of maize over that produced by either the organic matter or rock phosphate when used alone. The phosphorus in the organic matter was readily available to growing maize. The organic matter furnished phosphorus to the seedling and thereby promoted growth which may have enabled the plant to feed more strongly on the rock phosphate or the rock phosphate may have been made more available by the chemical and biological processes accompanying the decay of the organic matter.

A study of the growth of 15 different plants on rock phosphate in sand cultures showed a wide variation in the amount of dry matter produced. The crops tested were red clover, sweet clover, wheat, oats, maize, timothy, soy beans, rape, alfalfa, rye, buckwheat, red top, red sorrel, mammoth clover and alsike clover. Tables show the average yields of dry-matter of the tops, roots and plants as a whole, the proportion of roots to the whole plant when grown with rock phosphate, and the percentage growth made with rock phosphate compared with that made with acid phosphate are recorded; also the phosphorus and calcium content of plant tops and acidity of leaves, stems, and roots of plants grown with acid cultures with no potash, soluble potash and felspar potash.

Results show that there was quite a wide variation in the growth of the different plants with rock phosphate used at the rate commonly advised for field practice. Sweet clover and red sorrel produced the largest proportionate increases of dry matter and red clover the smallest. The increases of the former were about  $3\frac{1}{2}$  times greater than the latter. Sweet clover possesses remarkable feeding powers relative to rock phosphate and felspar and is well suited to rotations for their utilisation. With the exception of sweet clover which gave a slight increase, all the plants analysed showed somewhat distinct decreases in the percentage content of phosphorus when grown on rock phosphate as compared with acid phosphate. In general, neither the percentage content, nor the total amount of phosphorus in the plant tops was related to the amount of plant growth made with rock phosphate.

The acidity values of the juice of the leaves, stems and roots varied considerably with the different plants. In general the juices were more acid when grown with acid phosphate than with rock phosphate.

The possibility of growing crops of high feeding power to supply organic matter and available phosphorus in rotation with crops of low feeding power is a question of considerable practical importance in the utilisation of rock phosphate.

- 14 - **The Effect of Basic Slag upon Grassland and the Subsequent Crops.** — OLDERSHAW, A. W. (Agricultural Organiser for East Suffolk), in the *Journal of Agricultural Science*, Vol. XI, Pt. 3, pp 288-292. Cambridge, July 1921.

Two plots of grassland, each  $1\frac{3}{4}$  acres in extent, on a poor type of chalky boulder clay, were fenced off with wire netting; one was reserved for control purposes, and the other received a dressing of 10 cwt. per acre of basic slag, and a second dressing of a similar nature 8 years later. After 12 years of regular sheep grazing, on analysis of the first and second 9 inches of soil, the basic slag plot was found to contain 500 lb. of nitrogen per acre more than the unmanured plot.

The following year the plots were mown, ploughed up, and drained and sown with legumes and wheat successively, with dressings of superphosphate and sulphate of ammonia. The turf on the "slag" plot was very thick, and the yield was fairly high probably due to the thick growth of wild white clover. The increase in nitrogen as compared with the unmanured plot is only about 10 % whilst the increase in crop is much larger. It appears likely that the nitrogen assimilated being of more recent origin, would be more easily available to plants than the original nitrogen reserves of the soil. It is likely also that the extra plant residues left on the slagged plot, have a considerable influence on the mechanical condition of the soil and on its humus content. It is well-known that the presence of phosphate in heavy soil causes increased root development, but whether this applies also to slagged plots and the actual fate of the phosphates in this case, are points which still require investigation.

- 15 - **Results of Manuring with Superphosphate on the Yield and Quality of Indigo in India.** — See No 50, of this *Review*.
- 16 - **Effect of Phosphate Fertilisers in Conjunction with Green Manures, upon Spring Cereals in India.** — See No 50 of this *Review*
- 17 - **Availability of Organic Nitrogenous Compounds.** — ROBINSON, C. S., WINTER, O. B., and MILLER, E. J (Michigan Agricultural Experiment Station, East Lansing, Michigan), in *The Journal of Industrial and Engineering Chemistry*, Vol. XIII, No 10, pp 933-936, diagr. 1, New York, Oct 1, 1921.

Several years ago investigations were started with the following objects: a) to ascertain the relation between the chemical constitution of organic nitrogenous substances and the availability of their nitrogen for plant nutrition; b) either to devise a new method or to improve the existing methods for measuring this availability. Both these questions are of importance because of the growing tendency to utilise all sorts of organic nitrogenous substances as fertilisers.

Amongst the various methods put forward for the determination of the availability of nitrogen as regards the said substances, two only, both of them developed rather empirically, have shown themselves of comparative value; *viz.* the alkaline permanganate and the neutral methods. In the present investigation the authors made determinations, employing the alkaline permanganate treatment, of the active insoluble nitrogen in a number of amino-acids and acid amides, typical organic compounds of known constitution in which the nitrogen was combined in several ways. After this, further investigations were made in a similar way, on the well-known proteins or substances containing them. Finally analyses were made of samples of commercial nitrogenous fertilisers employing the same method and the nitrogen partition method of VAN SLAYKE. Data relative to these determinations are given as follows:

*Per cent of Total Nitrogen of Fertilisers in Various Forms.*

	Total nitrogen	Soluble nitrogen (ammoniacal and nitric) + active insoluble	Amide nitrogen	Amino nitrogen	Amide + amino nitrogen
Peat (dried) . . . . .	2.76 %	40.21 %	20.65 %	39.14 %	59.79 %
Peat (wet) . . . . .	3.49	42.40	13.46	39.53	52.99
Pulverised sheep manure . . . . .	2.34	28.20	14.53	41.8	56.41
Hay and silage . . . . .	3.10	16.71	6.13	42.22	48.35
Fruit and vegetables . . . . .	3.74	43.85	5.09	49.20	54.29
Bone meal . . . . .	2.48	46.43	4.84	49.20	54.04
Animal tankage . . . . .	4.40	56.94	7.95	54.31	62.26
Pure bone meal . . . . .	3.12	62.81	8.01	55.76	63.77
Castor bean cake . . . . .	4.78	48.96	11.09	55.85	66.94
Cotton seed meal . . . . .	6.73	50.51	10.33	58.09	68.42
Bone . . . . .	3.05	67.21	5.24	60.98	66.22
Glue hair . . . . .	8.19	64.55	5.89	66.77	72.66
Beef scraps . . . . .	8.72	74.54	5.96	68.11	74.07
Hair waste . . . . .	14.27	70.85	9.52	70.00	79.52
Dried blood . . . . .	14.01	71.31	6.56	75.23	81.79
Mixed chrome uppers . . . . .	9.88	51.22	4.76	60.32	65.08

Assuming that the ammonifying as distinguished from the aminifying or hydrolysing power of the alkaline permanganate solution is comparable with the action of soil agents, all amino nitrogen and a portion of the nitrogen present as acid amides may be said to be included. There is also another class of compounds termed the potentially available class, which may be converted into the former class. This includes a portion of the acid amides, the peptides which can be hydrolysed to amino acids, and primary and secondary amides. The peptides probably constitute the great bulk of this class so far as ordinary fertiliser materials are concerned. This is the uncertain quantity in evaluating any material from the fertiliser standpoint. In some cases transformation into the available class is



so easy and complete that there can be no practical distinction between the two. In other cases however this process is so slow that the unavailable class is approached. Fundamentally, the problem of the determination of the availability of organic nitrogen compounds is the possibility of a proper estimation of the rate of ammonification of the members of this class. Up to the present the permanganate methods have proved the most satisfactory and the authors will publish later the results of their further studies.

**18 - The Influence of Certain Fertiliser Salts on the Growth and Nitrogen Content of Some Legumes.** — MAC TAGGART, A. (Cornell University), in *Soil Science*, Vol. XI, No. 6, pp. 435-454, figs. 2, bibliography of 61 works. Baltimore, M. D., June 1921.

It has been fully demonstrated that calcium plays an important part in the soil in the symbiotic assimilation of nitrogen by legumes, but the activity of certain other fertilising elements has not been so fully shown. For this reason the author after a bibliographical survey of the literature on this subject, gives the results of a series of experiments made with 36 boxes filled with a soil mixture consisting largely of clean sand and about  $\frac{1}{2}$  of sandy loam with slightly more than 0.5 % of calcium carbonate added to each box. The moisture content of the soil was maintained throughout at 10 % (on the dry-soil basis). Half of the boxes were filled with alfalfa and half with peas. The boxes were divided into 9 series of 4 and treated as follows: 1) control; 2) nitrogen (dried blood); 3) phosphorus (disodium phosphate); 4) potassium (muriate of potash); 5) sulphur (gypsum); 6) nitrogen, phosphorus, potash and sulphur in above forms; 7) nitrogen, phosphorus, and potash *idem*; 8) nitrogen, potash and sulphur; *idem*; 9) phosphorus, potash and sulphur, *idem*. Previous to sowing, all the boxes were inoculated with sand cultures. Following the crop of field peas, soy beans were sown, after suitable inoculation of the soil, application of calcium carbonate and fertiliser.

Of all the fertiliser elements applied, the phosphorus showed the most marked effect. Alone, it distinctly increased the dry matter and total nitrogen, and to a lesser extent the percentage of nitrogen in all 3 legumes; the order of average influence on the crop being: field peas, soybeans and alfalfa.

In combination with nitrogen, potassium, and sulphur, phosphorus markedly increased the dry matter and total nitrogen in peas, soybeans and alfalfa. However, it increased on the contrary the percentage of nitrogen in soybeans and alfalfa only slightly, and decreased the percentage in the case of peas.

Nitrogen as a single element can hardly be said to benefit the plants with respect to yields of either dry matter or nitrogen, except perhaps in the case of field peas. In combination with phosphorus, potassium and sulphur, nitrogen did not produce any lasting effect where it was employed alone; in fact, there was perhaps less response. It may be concluded also that nitrogen in combined form does not hinder nitrogen assimilation by legumes. Potassium used alone caused an increase in the total nitro-

gen and dry matter in field peas and alfalfa in the order named, but a decrease with respect to these factors in soybeans. Only in the percentage of nitrogen did potassium show an increase common to all 3 crops, in the order named above. Sulphur in the form of gypsum used alone or with other fertilisers somewhat increased the growth and nitrogen content of alfalfa, but does not appear to have had any effect on field peas and soybeans.

Taking into consideration the influence of the fertilisers employed for nitrification purposes or rather to assist in the nitrogen accumulation in the soil, the most marked effect generally was produced when phosphorus was applied, which resulted in the distinct development of the crops. Nitrogen applied alone increased soil nitrification after the harvesting of all three crops, particularly after alfalfa, but when applied in combination with other fertilising substances, it did not have this effect. Potassium, in the form of muriate of potash, apparently slightly inhibited nitrate-nitrogen accumulation; the sulphur, in the form of gypsum, increased nitrification subsequently in the soil. In general, there appeared to be a tendency toward correlation between the dry matter produced and the subsequent soil nitrification, due probably partly to the greater root system associated with increase in top growth, and hence to greater amounts of decayed roots, favourable to nitrification.

19 - **Carbonication of Plants By Combustion Gases.** - RIEDEL, F, in *Chemiker Zeitung*, Year XLV, No 104, pp 829 830 Cothen, August 30, 1921.

After having disposed of the various objections raised in connection with the practical installation of plant for the carbonisation of crops in the open field by means of combustion gases, especially those from siderurgical works (1) the author gives figures showing the economic returns from the process. He calculates that for the carbonication of one hectare of land, 500 m. of cement pipes with a diameter of 10 cm. are required; the distance between the pipes being 25 m. The price of the pipes in March 1921, was 7.5 marks per metre; counting transport and laying, the cost would work out at 12 marks the metre which would make 6000 marks per hectare; by adding a similar sum for the cost of the chief gas pipe and various expenses, the total amount would be 12 000 marks per hectare or 1.2 marks per sq. metre.

Calculating the working expenses per square metre the following figures are obtained;

	Marks
20 % depreciation and interest . . . . .	0 24
Cost of extra mineral fertiliser required . . . . .	0 12
Repairs . . . . .	0.08
Cost of extra labour necessitated by heavier crop . . . . .	0 10
Marks . . . . .	0.54

(1) See R. June 1920, No 626. (Ed)

If as a result of the carbonication, the potato crop is doubled; that is to say if it rises from 1.75 kg. to 3.50 kg., the net profit in the case of potatoes fetching 0.60 marks the kg., will amount to 0.51 marks per square metre or 42 %, and if early potatoes are grown, the profit is even higher. The prices quoted above are for installations that can use the discharge of gas motors which finds its way to the soil of its own accord; should ventilators for the expulsion of the gas be needed, this would mean an extra expense of some pfennige, but in any case there would be a good margin of profit.

As regards the larger water requirements of crops subjected to carbonication the author states, that the greater development in length of the plants' root systems enables them to make better use of the reserves of water in the soil. It may however be the case that in years of drought the full-benefit of carbonication can only be obtained by the application of carbon dioxide.

- 20 - **A Systematic Catalogue of the Plants Cultivated in Spain (Species and Varieties) and of the Principal Species of Trees.** - DANTIN CERCEDA J., *Catálogo metódico de las plantas cultivadas (especies y variedades) en España y de las principales especies arbóreas; Servicio de publicaciones agrícolas de Ministerio de Fomento*, pp. 62, figs. 22. Madrid, 1920.

AGRICULTURAL  
BOTANY,  
CHEMISTRY  
AND  
PHYSIOLOGY  
OF PLANTS

With this work of enumeration and identification which extends as far as possible even to varieties, the author begins his phytographical study of the plants cultivated in Spain. He does not pretend to have made a complete list, although many of the popular names he gives are recorded for the first time. In this catalogue, there are 422 species with their botanical names and the popular names by which they are known in the different Provinces of Spain. Then follows a table of 1000 popular names, and a bibliography of the 13 works most frequently consulted.

- 21 - **"Arroz brabo", Wild Rice in the Interior of Brazil.** - A Lavoura, year XXV, Nos. 8-9, pp. 219. Rio de Janeiro, September 1921.

In the State of Goyaz and in the inundation zone of the Araguaya, there are large quantities of a wild cereal much resembling rice, and known in the country by the name of "arroz brabo" (wild rice).

This plant only differs from common rice in having looser panicles and more brittle seeds.

In the neighbourhood of the river Jaoahé, "Arroz brabo" is used with much success in fattening stock.

- 22 - **Composition of Californian Citrus Fruits.** - CHACE, E. M. (Chemist in Charge), WILSON, C. S. and CHURCH, C. G. (Assistant Chemists, Laboratory of Fruit and Vegetable Chemistry), in *United States Department of Agriculture, Bulletin No. 933. Contribution from the Bureau of Chemistry*, pp. 1-18, figs. 4, bibliography of 5 works. Washington, Oct. 15, 1921.

From 1887, when 12 cartloads of citrus fruits were exported from California, until 1919-20, when 12 000 were exported, the cultivation of Californian fruits has been very widely extended. The varieties grown to the largest extent at present owing to their suitability to Californian conditions, are "Eureka", native of California raised from Si-

cilian citrons, and the "Lisbona", widely spread and imported directly from Australia. The authors have analysed the fruits of these two varieties and also of a third, viz. "Villa Franca", at the present time not grown. It is considered advisable that the grower should be kept acquainted with the data relative to the composition of the fruits no less than the manufacturing establishments directly connected with the products, such as oils and citric acid.

The results obtained indicate the comparatively negligible differences existing between the various characters of the varieties studied. The most outstanding are those with reference to the specific weight of the fruits; the Eureka seems to stand at the top and the two others were practically identical. As regards the essential oil content, the var. "Villa Franca" showed the highest percentage, whilst "Eureka" gave a somewhat lower percentage. Although no difference was noticed in the citric acid content, there was a marked difference in the sugar percentage between the Eureka and "Lisbona" varieties.

Acidity attains its maximum at the beginning of autumn; the maximum specific weight is reached towards midsummer, and the minimum during winter. The minimum essential oil content was found to be at the end of winter and in the spring, and the maximum in the autumn.

No correlation was observed between the colour of the bark, its thickness and the composition of the fruits, but the specific weight and the acid content became less with the thickening of the bark. No difference was observed between fruits obtained on the sea coast and those from inland.

23 - **A Study of Nitrogen and Root Space as Factors Limiting the Yield of Maize in Egypt.** — PRESCOTT, J. A., in *Sultanic Agricultural Society, Technical Section, Bulletin* No. 4, pp. 1-14, figs. 6 Cairo, 1920

The response of the maize crop to nitrate of soda has been shown as the result of field experiments conducted by the Sultanic Agricultural Society at Bahtim, to follow very closely the mathematical expression of MITSCHERLICH relating to the Law of the Limiting Factor (*Landw. Jahrb.* XXXVIII, 1909, p. 537; *Landw. Versuchs. Stat.*, LXXV, 1911, p. 231; LXXVIII, 1912, p. 127).

The dressing of nitrate of soda usually recommended in Egyptian farming is 150 kg. per feddan (1 feddan = 1.038 acre), but 200 kg. is frequently employed as a standard of comparison. In this experiment it was found that up to 300 kg. there was a steady increase in yield of crop, but if 400 kg. was applied, there was a smaller yield. Whether this diminution is due to the harmful effects of excess of nitrogen or of excess of sodium salts remains yet to be ascertained and the author proposes the repetition of the experiment, using ammonium nitrate instead of sodium nitrate.

It is frequently the case that the use of large quantities of nitrogenous manures retards the maturation of the crop; in the Bahtim experiments, however, no retardation has been observed.

The author includes data relative to harvest, effect of increasing dressing of sodium nitrate, etc.

*Root Space as the Limiting Factor.* — The spacings adopted varied from 25 cm. up to 95 cm. The original plots were each  $\frac{1}{10}$  feddan and were subsequently divided into two parts, the northern half receiving nitrate of soda at the rate of 150 kg. per feddan and the southern half being left unmanured :

In both the manured and unmanured series the mathematical expression of MITSCHERLICH can be applied with fair agreement.

The yield per feddan, according to the given curves, can be related to the number of plants per feddan, giving a maximum yield at the spacing of about 16 000 plants per feddan (nitrate series) and of 10 000 plants per feddan (unmanured series). It is significant that the local method of planting gives an intensity of about 12 000. However, within fairly wide limits, the yield does not appear to vary very much and it seems probable that the maximum crop would be between 12 000 and 20 000 in the nitrate series and between 8 000 and 14 000 in the unmanured series.

During the growth of the plant, weekly observations were made on the heights of the unmanured plants, the measurements being made to the tip of the longest leaf and later to the end of the tassel; curves are here given for the recorded heights. The plants in all the spacings grew together for the first 15 days after which there was a successive breaking away; it is thus possible to trace the course of the lateral root development and interference during the course of the season. The following data indicate this development during the growth period (diameter in cm.) for 5 successive fortnightly periods, *viz.* 25, 35, 45, 65, 85.

The author includes data relative to harvest as a result of sodium nitrate treatment and also for the spacing experiments, and curves, etc. showing the effects produced in every case.

24 — **Observations on the Growth of Maize in Egypt.** — PRISCOTT, J. A., in *Sultanic Agricultural Society, Technical Section, Bulletin No 7*, pp 1-25, figs. 10, tables 11, Cairo, 1921

During the seasons 1918 and 1919 observations were made in 3 different ways on the growth of maize.

I. AUTOMATIC RECORDS OF GROWTH RATE. — The curves given indicate that there are two maxima during the 24 hours; at no time does the maize plant stop growing altogether but at daybreak there is usually a slight decrease in the height probably associated with the opening of the stomata and the loss of water due to the resumption of day time transpiration. This is followed by a rapidly increasing rate of growth until the hotter part of the day is reached when a slight retardation is observed; in the late afternoon there is again an acceleration giving a new maximum about sunset. During the night the growth rate falls off gradually to the minimum just before sunrise. A retardation of growth rate due to the soil water factor is shown in all the curves though only to a slight extent. Measurements made in 1918 by MOSSÉRI in his garden at Giza show the growth of plants during 12-hour periods of day and night, and it appears that growth in the night hours from 8 p. m. to 8 a. m. tends to

be greater than in the day time 12 hours period, doubtless owing to the check during the hotter part of the day.

II. DAILY MEASUREMENTS OF GROWTH RATE ON SELECTED MAIZE PLANTS. — The temperature and humidity records were taken from the mean data for Abbassia and Giza supplied by the Physical Service of the Ministry of Public Works. The curves for the 3 day means are given. The main features brought out are in the first place the effect of irrigation on growth (after each watering there is a marked increase in growth rate) ; this is shown particularly well in the 1919 curves where the soil moistures are given. There is also a fairly close relationship between the temperature and growth rate in the early part of the season, when soil moisture is abundant. This relationship becomes less noticeable as the plant becomes more developed and the soil moisture conditions intervene.

In 1919, an experiment was planned in which soil moisture determinations were made every 2 or 3 days so that as soon as the water content, (depth 20 to 40 cm.) approached 25 % of the dry soil, irrigation was possible. It was found necessary to irrigate more frequently than usual and a slight benefit was obtained in the final yield. Later experiments indicated that with heavy manuring the effect of the water factor on the yield became more marked. The adjoining table indicates that frequent irrigation as controlled by soil moisture gave a yield (stalks and ears respectively) of 4760 kg. and 1510 kg. per feddan, and the yield with normal irrigation (7 times between July 7 and October 22) of 4630 kg., and 1460 kg. There was also an increase in the heights of plants when irrigations were more frequent *e.g.* frequent irrigation, mean height of 40 plants 1) to leaf tip, (18 to 46 days), 55 to 210 cm. ; normal, 55 to 202 cm. ; 2) to tassel (46 to 67 days), — frequent, 158 to 274 cm. ; normal, 151 to 266 cm.

III. WEEKLY MEASUREMENTS AS RESULT OF SOWING EXPERIMENTS. — The normal time for planting maize in Egypt is towards the end of July. In 1919, however, sowings were made from the beginning of April until the end of September and weekly observations were made of the growth and development of the plants throughout the season. The variety employed was the Bahtim "Surecropper", long season semi-dent variety.

Growth and development curves are given for the various sowing dates ; these correspond with the figures given. The physiological development of the plants shows the same characteristics in the curves of leaf development, tasselling, silking and maturation. These features are also brought out according to the isophytic diagram. The best growing conditions for the maize plant in Egypt are evidently to be found late in July and during the month of August. The amount of growth, including time for germination in the first 21 days after planting, shows how far temperature plays a part in determining the rate of development of the maize plants. Germination in the case of the April sowing took place in 12 days, in the May sowing it was 10 days, while in July sowings the time is normally 5 or 6 days. Although the mean temperature at the end of August is about the same as early in June, the night temperatures are more favourable than at the earlier period. The following table shows the comparative

yields of maize sown at different periods and the heights at 21 days after planting.

Date of sowing	Comparative yield * of grain	Height of plant	Temperatures (°C.) Average for 21 days		
			Maximum	Minimum	Mean
April 1 . . . . .	56	24.6 cm	29.6	11.4	20.5
May 1 . . . . .	63	25.1	30.4	12.2	21.3
June 1 . . . . .	84	43.5	33.7	14.8	24.2
June 15 . . . . .	88	51.7	34.7	16.2	25.4
June 29 . . . . .	92	61.6	36.8	17.4	27.1
July 13 . . . . .	100	69.1	36.3	18.7	27.5
July 27 . . . . .	96	62.2	35.5	18.5	27.0
August 10 . . . . .	86	59.1	35.7	18.5	27.1
August 24 . . . . .	—	62.8	33.3	17.1	25.2
September 7 . . . . .	64	51.9	31.7	15.4	23.5
September 21 . . . . .	30	—	—	—	—

(\*) Maximum yield in sowing of July 12 being taken as 100.

From a consideration of the mean weekly maximum and minimum temperatures at Bahtim (April to November), it seems clear that the optimum growing weather in Egypt for maize occurs during the month of August; at this time night temperatures are higher than at any other time of the year and during the day time the effects of water strain on the plants is likely to be much less in evidence than during the month of July.

25 - The "Pure Line" and the "Pure Chain": a Contribution to the Terminology of Genetics. — PRELL, G., in *Zeitschrift für induktive Abstammungs und Vererbungslehre* Vol. XXVI, Parts 3-4, pp. 287-294. Leipzig, July 1921.

PLANT  
BREEDING

The term "pure line", in the sense in which it is used by JOHANNSEN, should be employed exclusively for groups of individuals derived from an autogamous stock by means of repeated self-crossing. It is however often used also to designate groups of genetically isolated individuals derived from two allogamous parents. The necessity of finding a distinct and suitable term for this second class of individuals has long been felt and the author proposes the expression, "pure chain", ("reine Kette").

Thus we have:

**Pure Line.** — The entire group of individuals descended from a single autogamous, homozygous stock.

**Pure Chain.** — The entire group of individuals descended from two allogamous stocks which are isogeneous (isozygotes and homozygotes), only as regards sex and the characters with which they are possibly connected (heterozygotes only as far as sex is concerned).

The two groups differ in the number of diplonts (diploid numbers of chromosomes) necessary to their formation and in the nature of the

relations existing between the haplonts (haploid numbers of chromosomes), that unite to form the diplont. In pure lines, the point of departure is a single diplont, and the whole genealogical tree can correctly be represented as a simple *line*. On the other hand, the pure chain starts from two diplonts, so that in the genealogical development, there are two diplont forms that constantly coalesce and separate according to the same rule, thus producing the exact image of a *chain*.

The haplonts of a pure line are identical, from the genetic and typical standpoint, whereas the haplonts of the chain differ in the factor or group of factors of sex. The contrast between the line and the chain is specially noticeable when there are other morphological factors united to those of sex; in this case, the heterozygotism of a diplont is accentuated.

26 - Study of Barley Hybrids, Especially from the Standpoint of Fixity of the Segregation of Characters in the  $F_2$ . - BLARINGHEM, L., in *Annales de la Science agronomique*, Year 38, Series 6, No 4, pp 177-230 Paris, August 1921.

The visible morphological characters of barley grain are indices which allow varieties suitable for the brewery to be distinguished from those suitable for cropping. These characters are regularly transmitted in a large number of lines and can be used as a test of the botanical purity of each kind.

The author gives the results of a series of experiments relating to two characters 1) hairs on axis of spikelet: *stiff* (A), or *downy* (a); 2) lateral dorsal veins of the seed: *rough* (B), or *smooth* (b). These two pairs of characters behave as independent Mendelian units in crosses between pure form of the variety *Hordeum distichum nutans*.

HAIRS ON AXIS OF SPIKELET. — The pair  $Aa$  obeys the Mendelian law in 29 crosses (with 110  $F_1$  hybrids and 5422  $F_2$  hybrids), between varieties belonging to the Linnaean species, *Hordeum distichum*, *H. nudum* and *H. tetrastichum*. In every case and in all the combinations, the ratio of stiff-haired to downy-haired individuals in the  $F_2$  was as 3:1. This cha-

TABLE I. — Segregation in the  $F_2$  Generation  
of Crosses between Forms of *H. distichum nutans*.

Crosses	Total number of $F_2$ plants	Plants with	
		Stiff hairs	Downy hairs
0.185 ♀ × 0.431 ♂ . . . . .	39	32	7
0.236 ♀ × 0.431 ♂ . . . . .	343 (344)	262 (259)	81 (85)
0.385 ♀ × 0.190 ♂ . . . . .	27	21	6
0.431 ♀ × 0.185 ♂ . . . . .	36	26	10
0.431 ♀ × 0.185 ♂ . . . . .	23	15	8
0.431 ♀ × 0.236 ♂ . . . . .	406 (408)	304 (306)	102 (102)
Totals . . .	874 (880)	660 (660)	214 (220)



racter therefore manifests itself independently of the nature of the above-mentioned 3 species upon which it is possible by means of suitable crossings to impress at will the character of stiff hairs or downy hairs respectively.

It remains to be seen whether these characters are of any importance from the industrial, agricultural or commercial standpoints.

The same numerical relations are found in the crosses: *H. distichum nutans* × *H. distichum erectum*, *H. distichum* × *H. nudum* and *H. distichum* × *H. tetrastichum*.

TABLE II. — Segregation in the  $F_2$   
of Crosses between Forms of *H. distichum nutans* (1909).

Crosses				Total number of $F_2$ plants	Plants with	
					rough veins	smooth veins
Bohemia ♀	0.236	♂	. . .	524 (520)	392 (390)	132 (130)
0.236 ♀	Bohemia	♂	. . .	629 (640)	481 (480)	148 (160)
0.185 ♂	0.236	♂	. . .	47	36	11
0.185 ♀	0.431	♂	. . .	39	29	10
0.431 +	0.185	♂	. . . . .	36	33	5
0.431 ♀	0.185	♂	. . . . .	24	15	8
Totals . . .				1298 (1300)	986 (975)	312 (325)

DORSAL VEINS. — The pair **Bb** on the other hand behaves somewhat differently from the pair **Aa**. These characters are only independent in the variety *Hordeum distichum nutans* (which includes all the best brewing barleys), and solely in the 1906 crosses. In the  $F_2$ , individuals with rough veins and smooth veins occur in the ratio 3 : 1.

On the other hand much segregation is already found in the crosses made in 1907 (all between forms of *H. distichum nutans*) as is shown in Table III

Similar cases of segregation occurred in 1908: the author suggests, that they may be explained by the greater plasticity of Chevalier II, Hannchen, and the lines 0.190, 0.385 and 0.219 as compared with the lines 0.236, 0.431 and the form Bohemia. If this is the case the pair of characters *presence* — *absence of bristles* would be a more significant association in proving the fixity of the lines than the pair *stiff hairs* — *downy hairs*. This seems to be proved by the behaviour of the hybrids arising from crosses between 0.501 (line of *H. distichum erectum* with smooth veins), and 0.631 (line of *H. distichum erectum* with rough veins). In fact, in the  $F_2$  of crosses made in 1906, in the neighbourhood of Paris, the ratio of bristly individuals to smooth individuals was not as 3 : 1, but as 1 : 1, as if the lines 0.501 and 0.631 were fixed hybrids. In the crosses effected in 1906 out of the 91 (92) individuals of the  $F_2$ , 42 had rough and 49 had

TABLE III. — Segregation in the  $F_2$   
 Generation of Crosses Between Forms of *H. distichum nutans* (1907).

Crosses		Total number of $F_1$ plants	Plants with	
			rough veins	smooth veins
0.190 ♀	0.236 ♂ . . . . .	550 (552)	463 (414)	87 (138)
0.431 ♀	0.385 ♂ . . . . .	100 (100)	79 (75)	21 (25)
Totals . . .		650 (652)	542 (489)	108 (163)
0.109 ♀	× Chevalier II ♂ . . . . .	48	30	18
0.219 ♀	× Hannchen ♂ . . . . .	27	16	11
0.219 ♀	× Bohemia ♂ . . . . .	115	69	46
Totals . . .		100 (192)	115 (144)	75 (48)

smooth veins, instead of 69 and 23, as there should have been theoretically according to the ratio 3 : 1.

The crosses made in 1907 between the same lines, **0.631** and **0.521**, gave on the contrary different results; in  $F_2$ , the general ratio was 3 : 1 but there were individual variations, such as had not been observed among the former hybrids. Similar results were again produced in the case of cross **0.190** × **0.631** (and **0.631** × **0.190**): the progeny in the  $F_2$  dividing into 3 groups with very different ratios of segregation.

1st group = 3 : 1

2nd " = 1 : 1

3rd " = 9 : 7 or 15 : 1

The difference in the results observed from one year to another deserves notice, as it always occurred in the same types. The essential factor of genetic instability is to be found in line **0.631** (and perhaps also to some extent in **0.190**), but the author maintains that it is owing to the genetic instability of these types that the environment, and more especially the climate are able to alter the percentages (ratios).

This instability would manifest itself in the following manner in the crosses: supposing that **0.631** has a hybrid origin as regards the presence or absence of bristles, and that **A** (presence), is constantly dominant over **a** (absence). In this case, the uniformity and homogeneity characteristic of **0.631** would depend upon the condition that all the egg-cells with the character **A** were fertilised by **a** pollen, and reciprocally that all the **a** egg-cells were fertilised by pollen **A**. Crossing the heterozygous line **0.631** (**Aa**) with the homozygous line **0.190** (**aa**) gives the following combinations :

$$\begin{array}{l}
 \text{I} \left\{ \begin{array}{l} \text{pollen. . . } \mathbf{A} \\ \quad \quad \quad \downarrow \\ \text{ovule. . . } \mathbf{a} \end{array} \right. \quad \text{or} \quad \left\{ \begin{array}{l} \text{pollen. . . } \mathbf{a} \\ \quad \quad \quad \downarrow \\ \text{ovule. . . } \mathbf{A} \end{array} \right. \quad \text{II} \left\{ \begin{array}{l} \text{pollen. . . } \mathbf{a} \\ \quad \quad \quad \downarrow \\ \text{ovule. . . } \mathbf{A} \end{array} \right.
 \end{array}$$

which gives Aa, aA hybrids (with bristles), and aa aa hybrids (smooth) in the proportion of 1 : 1, just as was found in the progeny of the 1906 hybrids and in the 1908 group, *Cistercienne* × *Bohemia*.

This proportion was found in half the cases examined.

The great homogeneity observed in 0.631 is due to prolonged selection under determined (climatic) conditions of environment. Now it is quite possible that the same conditions of growth would act upon 0.631 × 0.190 in a manner quite different from that in which they would act upon 0.631, and that the regular fertilisation of all the 0.631 A ovules with a pollen (and reciprocally), would undergo some modifications (in the cross 0.631 × 0.190). Once the equilibrium is disturbed, the segregation ratios become irregular and vary from one year to another according to the variations of the environment that in any way effect the state of equilibrium.

It still remains to be demonstrated whether under given conditions of climate, soil, date of sowing, cultural operations, etc 0.631 degenerates, in a more or less irregular manner as regards the character of bristles.

Breeding experiments alone can answer this question, and so far, none have been carried out

It is however well to remember that *Svanhals* and *Primus* barleys, of which the genetic constitution is heterozygous, are fixed in Sweden and Germany, but rapidly degenerate (as regards this very character of bristles), when they are cultivated in dry years in Picardy and in Eure-et-Loir (France)

27 - **Studies in Linkage Relations in Maize made in the United States.** — EYSTER, W. H., in *Genetics*, Vol 6, No 3, pp 209-240, tables 32, bibliography of 20 works. Baltimore, May 1921

Results of a systematic search for linkages in maize, especially as regards the two characters tunicate ears (in which the glumes of the ear develop to such an extent that each kernel is entirely enclosed), and sugary endosperm, both dependent on the factor pairs represented as **Tu tu** and **Su su**. In previous tests the author obtained a certain number of reciprocal crosses between the tunicated and sugar heterozygotes (**Tu tu Su su**) and plants non-truncated with non-sugary endosperm (**Tu tu Su su**). The results are shown in Table I. It was estimated that groups **Su Tu**, **Su tu**, **su tu** would be equal. On the contrary however in every case there was an excess of **Su Tu** and **su tu** respectively over **Su tu** and **su Tu**. The tendency of these factors (**Su** and **Tu**) to remain together in inheritance can be explained by assuming that they are located in the same chromosome. But should this follow a fixed rule, the groups **Su tu** and **su Tu** should be missing. Admitting however the undeniable existence of the linkage between **Su** and **Tu**, the resulting exceptions may be explained by the crossing-over theory (1) viz. a certain number of chromosomes are located between the *locus* of **Su** and the *locus* of **Tu**; the chromosomes of the non-tunicated and non-sugary

(1) See R. Jan. 1918, No. 20, note (1) p. 54

plant are located in a similar fashion and the result is an exchange between homologous segments which become united to form new chromosomes; these should possess one only of the two characters previously linked together. The more this phenomenon is intensified and frequent, the more often will **Su tu** and **su Tu** be represented. In the case in question, the percentage of crossing over in the two groups of crosses, should amount to 26.94 and 38.85 % respectively.

The rate of crossing-over can neither be designated, fixed or constant ; it is readily influenced by prevailing conditions and by genetical factors supplied by the chromosomes.

In megasporogenesis (connected with the formation of egg-cells) the percentage of crossing-over in the case investigated, amounted to 21.1 and 30.5 %, while in microsporogenesis (connected with pollen grains), the average is higher than 8 %.

In a second series of genetical experiments the author has made a special study (using a certain number of selected crosses) of the relations between **Tu** and **Su** and other mutant factors :

- C** = colour of aleurone
- Sh** = shrunken endosperm
- I** = factor opposing the production of colour of aleurone
- G** = factor for golden plant
- R** = red aleurone
- B** = brown colour of plant
- lg** = leaves without ligules
- P** = coloured pericarp
- Pl** = purple anthers
- A** = anthocyanin pigmentation in leaves, and grain
- An** = semi-dwarf plants with anthers on the ears
- Bl** = brown blotches on leaves
- Cr** = crinkled leaves
- D** = dwarf plant
- F** = fine striping in the leaves.
- Fl** = floury endosperm
- J** = *Japonica* striping of leaves
- Pr** = purple aleurone in the presence of other aleurone factor pairs
- Ra** = *ramosa* ear
- Gs** = green striping of leaves
- V** = greenish-white seedling
- W** = white seedling
- Y** = factor concerned in the formation of yellow endosperm

The following data refer to the factor **C** (colour of aleurone). In the cross **Tu tu Cc** × **tu tu cc**, the progeny **Su Tu**, **Su tu**, and **su Tu su tu** are obtained in equal proportions (see Table II), which indicates that **C** is found in a chromosome different from that associated with **Tu** and **Su**. Similar conditions appear to exist in the following cases :

TABLE I. — *Linkage between Tu and Su and intensity of the phenomenon « crossing over ».*

Pedigree	Su tu	Su tu	su Tu	su tu	Percentage of crossing-over
<b>Tu tu Su su × tu tu su su</b>					
196 — 10 · 192 — 4 . . . . .	89	19	31	98	21.10%
198 — 9 · 192 — 3 . . . . .	147	57	63	127	30.46
140 — 4 · E 7595 — 11 . . . . .	90	35	21	70	26.94
<b>Totals . . . . .</b>	<b>326</b>	<b>111</b>	<b>118</b>	<b>295</b>	<b>26.94%</b>
<b>tu tu su su Tu tu Su su</b>					
E 7595 — 11 · 140 — 4 . . . . .	26	8	19	25	34.62%
E 8575 — 4 · 201 — 7 . . . . .	78	56	32	86	34.92
<b>Totals . . . . .</b>	<b>104</b>	<b>64</b>	<b>51</b>	<b>111</b>	<b>34.85%</b>

TABLE II. — *Cross Tu tu Cc × tu tu cc.*

Pedigree	Su Tu	Su tu	su Tu	su tu
362 — 365 . . . . .	31	32	36	36
366 — 367 . . . . .	67	64	83	84
368 — 369 . . . . .	53	53	54	58
370 — 371 . . . . .	54	68	60	69
<b>Totals . . . . .</b>	<b>205</b>	<b>217</b>	<b>233</b>	<b>247</b>

28 — **Type and Variability in Kafir (*Andropogon Sorghum*).** — CONNER, A. B., and KAPER, R. E., in *Texas Agricultural Experiment Station, Agricultural and Mechanical College of Texas, Division of Agronomy, Bulletin No 279*, pp 1-14, figs. 6. Brazos County, Texas, April 1921.

The object of this study is to present data as to type and variability of certain characters in *Andropogon Sorghum* resulting from statistical research. The data given are taken from material accumulated from 1915 onwards, involving the measurement of material from crib-run heads and selected population material and from lines successively inbred for single characters. This work was conducted at Texas Agricultural Experiment Station, Substation No. 8, near Lubbock, Texas, a region well adapted to the cultivation of sorghum.

In 1916, 669 crib-run standard blackhull kafir heads were measured and records were made as to :

1) Number of seed-bearing branches ; 2) Length of seed bearing branches ; 3) Number of nodes per head ; 4) Length of rachis or centre stem ; 5) Length of head ; 6) Weight of head ; 7) Weight of threshed grain. In succeeding work with progeny the following additional measurements were taken : 8) Height of plant ; 9) Diameter of plant ; 10) Number of nodes per plant ; 11) Weight of green forage.

The bulletin in question deals however with the first 4 features only. Eighty individual heads were selected for planting in 1917, comprising 8 groups, each group representing one of the extremes of the 4 pairs of characters involved. The selection for the 1918 planting, within a single group, included 10 heads taken from the single row in that group whose progeny conformed to the highest standard for the particular character for which selection was made. Accordingly the selections were made in each generation for a 4-year period. The method of selection adopted is clearly shown in the accompanying diagram. The tabulation of the data for population and for lines inbred for 4 generations is given in the form of tables and graphs, which show the type and variability existing in each population and line from year to year. The tables of statistical constants seem to be quite reliable, judging from the probable error in each case.

The 8 lines involved in every case showed uniformity and purity in the  $F_2$  generation. This is in accordance with the low percentage of cross pollination found by the authors in open-pollinated heads. The practical significance of this fact is two-fold : 1) It lends greater reliability to preliminary uncontrolled breeding work ; 2) It emphasises the value of the head-row method of breeding grain sorghums and gives a greater probability of obtaining pure lines.

The fact that marked progress was made in one only of the 8 lines involved, viz. the line selected for few seed bearing branches, emphasises the importance and value of selecting a large number of heads for the initial planting to increase the chances of including superior individuals.

The variability in the several lines, as shown in the tables, is less than in the populations, and is consistently uniform in the  $F_2$  and succeeding generations, further emphasising the purity of the lines in the  $F_2$  generation.

29 - **The Interesting Relation between the Appearance of the Globe Mutant in *Datura Stramonium* and the Behaviour of the Chromosomes.** — BLAKESLEE, A. F., in *Genetics*, Vol. 6, No 3, pp. 241-261. Baltimore, May 1921.

The "Globe" mutant in *Datura Stramonium* is characterised by depressed-globose capsules, by decreased vigour in growth and by the broad and only slightly toothed leaves.

In the *Datura*, the placing and behaviour of the chromosomes are closely associated in relation to the appearance of this mutation and to several others. Consequently there has been noted, in every case, a duplication of chromosomes giving rise to dimorphic gametes with 12 and 13 chromosomes instead of a single normal type with 12. These are called simple trisomic mutants ; in somatic cells one of the 12 sets is a trisome with three homologous chromosomes instead of the normal two.

1) When selfed, the mutant character is passed on to about 22 % of the descendants.

When crossed with a normal as the male parent, the mutant character is transmitted to about 26 % of the progeny. If however the pollen of a mutant is employed, the abnormal character is apparent in only about 2 % of the progeny.

The author has concluded therefore :

a) As a general rule, the mutant complex is transmitted through the egg cells and either not at all or only to a very limited extent through the pollen.

b) By crossing the mutant (♀) with the normal (♂), the number of mutants obtained in the progeny was inferior to that expected, which may be attributed to the lessened vitality of the mutant forms. Selfing continued for 10 generations has not increased the proportion of mutants in the progeny.

2) New Globe mutations under normal conditions have occurred in about 0.05 % of the descendants (1 out of 2000 individuals). The percentage is, however, distinctly higher, in cases which already contain the simple trisomic mutants. It is also higher when the mutant is used as the female parent, but when crossed with normals, there is no increased percentage of mutants in the progeny. It may be concluded therefore that new Globe mutations are caused by changes in the formation of the egg cells and rarely by changes in the pollen.

3) Normal plants show about 2.7 % of defective pollen grains; Globes about 8 %. The pollen sterility is then a characteristic of the Globe, as it is of the other simple trisomic mutants.

30 - Number of Chromosomes in Various Species of *Lactuca* (1). — MITSUHASHI ISHIKAWA, in *The Botanical Magazine*, Vol. XXXV, p. 130 Tokyo, July 1921.

The author has made a special study of the number, behaviour and size of 15 species and 5 varieties of *Lactuca*, several of which are found growing wild in Japan; the figures in brackets indicate the number of chromosomes.

<i>L. laciniata</i>	(9)	<i>L. chelidoniifolia</i>	(5)
<i>L. Raddiana</i>	(9)	<i>L. debilis</i>	(24)
<i>L. triangularis</i>	(9)	<i>L. stolonifera</i>	(8)
<i>L. Scariola</i> var. <i>sativa</i>	(9)	<i>L. repens</i>	(8)
<i>L. villosa</i>	(9)	<i>L. Matsumurae</i>	(8)
<i>L. Keiskeana</i>	(5)	<i>L. tamagawensis</i>	(8)
<i>L. lanceolata</i>	(5)	<i>L. chinensis</i>	(16)
<i>L. lanceolata</i> var. <i>platyphylla</i>	(5)	<i>L. dentata</i> var. <i>gemma</i>	(12)
<i>L. denticulata</i>	(5)	<i>L. dentata</i> var. <i>albiflora</i>	(12)
<i>L. denticulata</i> var. <i>pinnatifida</i>	(5)	<i>L. dentata</i> var. <i>alpicola</i>	(7)

As regards size and shape and number of chromosomes, 5 groups were distinguished, showing differences also of a general taxonomic nature.

(1) See *R. Feb.* 1918, No. 180 (Ed)

NAKAI has previously stated, taking as a base the morphological characteristics, that the Japanese species of *Lactuca* may be classified under 4 headings, *Lactuca*, *Crepidiastrum*, *Paraixeris* and *Ixeris*.

It is of interest to note that the two classifications, made according to the two different standpoints (taxonomic and cytologic) are in agreement. *Lactuca* corresponds to group 1, *Crepidiastrum* to group 2, *Paraixeris* to group 3, and *Ixeris* to group 4 and to a fifth group constituted by the author (1).

31 - The "Akala" (*Rubus Macraei* Gray), an Endemic Hawaiian Raspberry and the Possibilities of its Improvement by Hybridisation and Selection. --

ROCK, J. H., in *Journal of Heredity*, Vol. XII, No. 4, pp. 147-150, figs. 3, Washington, April 1921

The Akala berry grows wild in Hawaii and possesses varying characteristics, which permit a subdivision into several distinct varieties.

In Kanaï, it is an upright spineless shrub, only a few feet in height, with somewhat small, dry berries.

In Maui the plants resemble to a certain extent the typical species from Hawaii, but have more spines and the fruits are less than half the size.

*Rubus Macraei* prefers the slopes of the high mountains of Hawaii proper (on Hualalāi, Mauna Loa and Mauna Kea). The largest fruited specimens were discovered by the author in a volcanic cone, known as Hinakapanulla, situated 6000 ft. high, in a desert lava field. The Akala was found in abundance with *Acacia Koahawaiiansis*, *Coprosma pubens*, *Styphelia tameiameia*, and presented the appearance of a huge liana several feet long and with a woody stem 2 inches in diameter. The berries, of a dark rich purple colour were at least 2 inches in diameter. The plant is completely devoid of spines.

In the fern forests near the volcano of Kilanca there occurs another form of *Rubus Macraei*, also spineless, at least in older plants. This region has been given over to cattle grazing, and consequently the akala has gradually disappeared as a terrestrial plant and only the plants which became epiphytic have survived. These grow in the crevices of trunks and branches of trees and in the forks of moss covered trees. Although smaller than the berries found on the Hualalei and Mauna Kea Islands, they are always over 1 1/2 inches in diameter in spite of the lack of humus and of real soil.

(1) The unit characters to which may be applied or to which there is a tendency to apply Mendelian laws are regulated by the genetic factors in the chromosomes. Recently, the researches made in Japan and the United States (MORGAN etc.) have thrown considerable light on the question of chromosomes in the hereditary sense, and it has been concluded that a parallelism and intimate connection exist between the unit characters of the plant and the behaviour, number and forms of the chromosomes. The characteristics on the one hand and on the other, the chromatic constant which corresponds, constitute the two extreme points of the genetical inquiry. If much has been said and written hitherto concerning the characters, nothing really definite has been arrived at which confirms cytologically the Mendelian principles. It is therefore advisable to keep the plant breeding section well informed as to the most recent investigations on this subject. (Ed.)



The author has collected a number of species, especially on the windy slopes (6000 ft. elevation) of Mauna Kea. The air is always cool, the nights even cold, frost not being uncommon in winter. Every day after 11 o'clock the clouds ascend from the sea and the slopes of the mountain become shrouded in fog for the greater part of the day. Two distinct varieties are found; one dark purple and the other bright orange yellow; the first was almost spineless and the second was spiny. The fruits are very juicy and the seeds quite small; the dark variety is slightly bitter, while the yellow is quite sweet. Hybridisation should result in obtaining valuable types, specially adapted to slopes on the Pacific coast line with mild winters and liable to fogs.

- 32 - "Tangelolo", a New Citrus Fruit Obtained by Crossing the "Sampson Tangelo" with *Citrus decumana*. — SWINGLE, W. T., and ROBINSON, T. R., in *The Journal of Heredity*, Vol. XII, No. 4, pp. 151-153, figs. 1. Washington, April 1921.

In 1908 at Eustis (Florida), a new cross was obtained by using the pollen of the Sampson Tangelo, a hybrid resulting from using pollen of the Dancy tangerine on grapefruit (*Citrus decumana*).

Two of the seedlings thus obtained have fruited. The fruits resemble the male parent in general appearance (size, shape and character of rind), but on cutting, the colour of the pulp or rather the lining membrane and partition walls were found to be reddish pink. This colour often shows in small blotches on the rind which appears to be free from any bitterness or pungent oil and consequently very mild and edible.

With this characteristic and the attractive colour of the pulp, the fruit lends itself especially to the preparation of jams etc.

The marked influence of the male pollen is not only evident in the size, shape and exterior appearance of the fruits, but also in the characteristics of the leaf which is large and rounded. Cultural tests are at present in progress with a view to the establishment of the economic value of this new hybrid and to ascertain the possible advantage of the continuation and propagation of this fruit.

- 33 - Determination of the Origin of Linseed on the Market. — P. FILTER (Landwirtschaftliche Kontrollstation, Berlin), in *Die Landwirtschaftlichen Versuchstationen*, Vol. XCVIII, Parts 5-6, Berlin, 1919.

The determination of the origin of the different linseeds of commerce is sometimes a matter of great importance, for the oil content, rapidity of drying, impurities, etc. differ considerably according to the country from which the linseed comes. Thus Bombay linseed contains, on an average, 43 % of oil, Russian linseed about 37 % and Japanese linseed 35 %.

The author directed his attention chiefly to the investigation of linseed from the principal sources of the world's supply — Argentina, British India, North America and Russia, but he also extended his examination to linseed sent from China, Japan, Persia, Morocco and Turkey. The results are set forth in a series of tables from which are taken the averages given in the following Table. In order to determine the fat

content, the seed was first coarsely crushed and extracted with anhydrous ether, then finely ground and again extracted, 2 to 3 % more oil being obtained by the second operation. The drying was effected by a current of gas.

The oil content found by the author is generally a little higher than that given by HASELHOFF (*Landw. Versuchs-Stationen*, 1892, Vol. 41, p. 58), or by SCHINDLER (G. HEFTER, *Technologie der Fette und Öle*, p. 7).

As a rule, the weight of 1000 grains is greater in tropical and subtropical countries and less in the temperate, and it thus affords some index of the origin of the linseed.

The fat content is of much less significance; the position of the country of origin in this respect is as follows (in descending order). British India (Bombay) — Turkey — British India (Calcutta) — China — Morocco — Argentina — South Russia — North America — Persia — North Russia. The fact that the oil content varies considerably in the same place according to the year, greatly detracts from the value of this character in the identification of the origin of linseed.

The impurities are of much more importance in this respect, especially those classed as "characteristic weed seeds", for they nearly always indicate the country of export.

*Characters of Linseed of Different Origins.*

Source	No of samples analysed	Fat content	Water content	Weight of 1000 grains	Coefficient of purity
Argentina . . . . .	25	39.68%	4.96%	6.0272 gm	97.6%
Bombay . . . . .	6	13.36	3.63	7.4122	96.6
Calcutta . . . . .	3	41.27	4.48	5.1196	96.9
Turkey . . . . .	6	42.30	4.08	7.0723	95.1
Morocco . . . . .	6	40.17	4.45	9.3555	96.6
South Russia . . . . .	7	38.78	5.01	5.5541	91.7
North Russia . . . . .	9	37.37	4.73	4.1371	92.0
Volga, Siberia, Viatka, Kama, Rajow . . . . .	4	36.89	5.20	4.0647	90.3
Canada . . . . .	4	38.42	4.50	4.4419	98.2
United States (Minnesota) . . . . .	4	39.12	4.54	4.7318	98.7
China . . . . .	6	40.94	4.38	4.7440	96.0
Japan . . . . .	6	38.84	5.94	3.8479	96.0
Persia . . . . .	2	38.55	4.22	5.5025	95.6

The author gives for each country of origin the list of the weed seeds found among the impurities; he also gives a Table showing the distribution of the total number of the weed seeds discovered (141 species). These data allow the characteristic species to be determined for the various countries as follows:

ARGENTINA. — Characteristic species: *Ceratochloa australis* (Bro-

*mus unioides*) — *Brassica campestris* — *Anthemis Cotula* — *Melilotus parviflorus* — *Lolium brasilianum* Nees — *Centaurea melitensis* — *Rumex pulcher* — *Phalaris minor*; accessory species: *Silybum Marianum* — *Silene gallica* — *Lolium temulentum*. As the seeds of several species of these weeds are always present in large numbers there is no difficulty in recognising linseed from Argentina, the country which supplies most of the linseed to the markets of the world. The absence of *Cuscuta epilinum* is characteristic.

NORTH AMERICA (UNITED STATES AND CANADA). — The weed seeds chiefly found in linseed from these countries are: *Grindelia squarrosa* — *Helianthus annuus* — and *Sisymbrium Sinapistrum*. The two first species are exclusively North American, the third is also found in linseed from South Russia. Accessory species. *Erysimum orientale*, *Polygonum Convolvulus*; other species of *Convolvulus* and *Cuscuta epilinum* are absent.

BRITISH INDIA (BOMBAY AND CALCUTTA). — Typical impurities: *Brassica campestris* var. Sarson (= *Sinapis glauca* Roxb — *Brassica glauca* Wittm) — *Brassica dichotoma* Prain — *B. juncea* H. f. and T. — *Asphodelus tenuifolius*. The three first are typical Indian varieties. The following are also found: *Lathyrus sativus* var. *indicus*. — *Cicer arietinum* (variety with small brownish-red seeds) — *Gurzotia abyssinica* — fragments of the integument of *Ricinus communis*. Indian linseed is easily recognised owing to the constant presence of Indian species of *Brassica*.

As linseed from Calcutta and Bombay contains the same impurities, they are of no assistance in discriminating between the two products, which can however be distinguished by the weight of 1000 seeds and the oil content, both of which are higher in Bombay than in Calcutta linseed as is shown by the Table.

NORTH RUSSIA. — This term is chiefly applied to the eastern maritime provinces. The following characteristic impurities are always present in large quantities: *Polygonum lapathifolium* — *P. Persicaria* — *Lolium remotum* — *Spergula maxima*. None of these species is exclusively Russian but taken together they form a characteristic feature.

Accessory species: *Camelina dentata* — *C. sativa* — *Centaurea Cyanus* — *Chenopodium album* — *Galeopsis Tetrahit* — *Thlaspi arvense* — *Matricaria inodora* — *Galium Aparine* — *Anthemis arvensis*. The Japanese linseed resembles the Russian in containing *Spergula maxima* and *Lolium remotum*, but differs from it in being free from *Polygonum lapathifolium* and *P. Persicaria*.

SOUTH RUSSIA. — Characteristic impurities. — *Sinapis — dissecta* — *S. alba* — *Brassica elongata* — *Melilotus officinalis* — *Brassica Besseriana* Andr. — *Coronilla varia*. As the impurities are generally very numerous and include the seed of more than one species, it is nearly always possible to recognise linseed of South Russian origin.

Accessory species: — *Sinapis arvensis* (more common in this linseed than in any other) — *Eruca sativa* — *Convolvulus arvensis* — *Panicum milliaceum* — *Vaccaria parviflora* — *Setaria viridis* — *Glaucium corniculatum* — *Allium rotundum* — *Raphanus sativus*. All these species are

also to be found in linseed from other localities, but taken together, they are very characteristic of South Russian linseed.

It is thus evident that there is a distinct difference between linseed from North and South Russia respectively. Linseed from Siberia (of which only one sample was examined), contains the impurities characteristic both of the South Russian (*Sinapis dissecta*), and Chinese (*Corispermum hyssopifolium*) products.

MEDITERRANEAN COUNTRIES (MOROCCO, TURKEY). — It is not difficult generally speaking to recognise linseed from the Mediterranean region, but there are variations in the products of the different countries and the Moroccan and Turkish linseed examined presented very marked differences. The following species of weed seeds characterise the linseed of the Mediterranean countries: *Torilis nodosa* — *Arthrolobium scorpioides* — *Bupleurum protractum* — *Chrysanthemum coronarium* — *Cephalaria syriaca* — *Phalaris brachystachys*, *Ph. canariensis*, *Ph. paradoxa* — *Bromus maximus* — *Trigonella Foeniculum-graecum* — *Silene cretica* — *Raphistrum orientale*. The Morocco linseed contains special impurities in the form of *Bromus maximus*, *Chrysanthemum coronarium*, and *Bupleurum protractum*; Turkish linseed contains *Silene cretica* and as accessory species: *Asperula arvensis* (very common) — *Salvia Sclarea* — *Rapistrum orientale* — *Coriandrum sativum* — *Scandix Pecten Veneris*.

CHINA. — Characteristic species: *Corispermum hyssopifolium* — *Brassica Besseriana* Andr. (sub. species with yellow seed) — *Polygonum tataricum* — *Salsola Kali* — *Setaria italica*. Considerable numbers of the seeds of the yellow-seeded variety of *Brassica Besseriana* are found in Chinese linseed. The following are common as accessory species: *Setaria glauca*, *S. viridis* — *Panicum miliaceum* — *Eruca sativa*.

JAPAN. — Linseed from this country greatly resembles the linseeds grown in North Russia; it also contains: *Lolium remotum* — *Spergula maxima* — *S. arvensis* — *Camelina dentata* but is free from *Polygonum lapathifolium* and *P. Persicaria* which are common in linseed from N. Russia. *Brassica Napus* was only found in Japanese linseed. The presence of fragments of rice and of rice glumes serves also to distinguish Japanese linseed which is further characterised by the very light weight of 1000 seeds.

CEREALS  
AND  
PULSE CROPS

- 34 - Possibility of Growing Wheat in the State of Piahy, Brazil (1). — CABRAL, J. C., in *Brasil Agrícola*, Vol. VI, No. 2, pp. 12, fig. 1. Rio de Janeiro, August 1921.

Dr. João CABRAL, the Deputy for Piahy, on the occasion of his visit to the Professional Agricultural Institute at Corrente, noticed a regularly-developed plot of wheat in the experiment field of the Institute.

(1) This is the nearest point to the Equator at which wheat has hitherto been grown in Brazil. It is said, that this cereal was cultivated in Pará by the first colonists, but that rust drove the wheat plant continually southwards. For some years however a fresh attempt has been made to increase wheat production and positive results have been obtained from experiments carried out in numerous places in the state of Minas Geraes. It is quite impossible to grow wheat beyond the northern limits of this State, but as soon as Bahia is reached, this cereal is cultivated with *Hevea*, cacao, and manioc, at only 8° south latitude.

The climatic conditions of the State of Piahy are similar to those in North-east Brazil, where the copious rainfall and high temperature are favourable to the cultivation of rubber and manioc.

35 - **Kanota: An Early Oat Introduced into Kansas, United States.** — SALMON, S. C., and PARKER, J. H., in *Agricultural Experiment Station, Kansas State Agricultural College, Circular 91*, pp. 1-13, tables 61, figs. 2. Manhattan, Kansas, August 1921

Kanota oats were first grown at the Kansas Agricultural Experiment Station in 1916 when 4 lots of seed from Texas, all called Red Texas or Red Rustproof were received. Kanota belongs to the red oat group, *Avena sterilis*, characterised by a brownish red coloured grain, sucker mouth and basal hairs. The awns, however, are usually missing or, if present, are poorly developed and the young plants assume at an early age a semi-erect position. These three points appeared to differentiate it distinctly from the Red Texas oats. Kanota appears to occupy an intermediate position between the red and white groups which suggests hybrid origin with characters associated with *A. sativa* (northern) and *A. sterilis* (southern) and this may explain its geographic adaptation.

As regards the appearance of the grain, Kanota is identical with other Fulgum strains, but the difference in certain agronomic characters and in agronomic value is evident according to the experimental results obtained at Kansas 1917-20. The average yield for the 4 years has been 47.1 bushels per acre which is 10.9 bus. more than Red Texas, the variety previously regarded as the best available oat.

Kanota was first tested by Kansas farmers in 1919 and the table giving the comparative yields of this variety and a local strain of Red Texas shows a difference in favour of the first named variety, amounting to 15.3 bus. Further results in 1920 also demonstrate the advantages of adopting the Kanota variety.

According to the Table giving the dates of heading and ripening, Kanota evidently possesses the advantageous characteristic of early maturity. In early spring growth it resembles the white oat (*A. sativa* group), and in 1919 when this factor seemed to be a determining one with respect to production, Kanota made as rapid a growth as any other variety, tillered abundantly, and was not seriously hindered in its growth by weeds. All strains of Red Texas on the other hand made very slow vegetative growth, were damaged by weeds and gave low yields.

In field plot tests, Kanota produced grain of better quality than other varieties as regards weight. As indicated by the table, the average test weight was 5 lb. higher than Red Texas, 3 lb. higher than Burt and 8.1 lb. higher than the most productive Kherson; the average weight for the years 1917-20, was 33.7 lb. per bus.

In nursery and field plot tests the straw has been found to be slightly shorter than in other varieties, but there seems no reason to fear that the straw will be too short to bind and where lodging is likely to occur the short characteristic may be advantageous.

Observations made in the springs of 1920 and 1921 at Manhattan and

Hays, indicate that Kanota is somewhat more resistant to late spring frosts than Kherson oats and fully equal if not superior to Red Texas in this respect.

As regards resistance to disease, although Kanota belongs to the "red rust-proof group" *A. sterilis*, it is not resistant to *Puccinia coronata* nor to *P. graminis avenae*. However, although not immune from smut, (*Ustilago Avenae*), it shows a high degree of resistance.

It is estimated that about 8000 bus. of pure seed will be available for sowing purposes in the spring of 1922. It is proposed to inspect the crop and publish a seed list each year so that a supply of reasonably pure seed will be available at all times.

36 - Varieties of Rice Tested in 1921, in the Experiment Field of the "Granja arrocería" of Sueca, Valencia, Spain. — MONTESORO, E. G. (Director de la Granja arrocería de Sueca), in *Boletín arrocero*, Vol. VII, No. 98, pp. 1-3. Valencia, November 26, 1921.

Tests were made with 18 varieties divided into 3 groups: I) varieties that had already been tried for some years and were therefore acclimatised; II) New varieties imported from the Royal Riscultural Experiment Station of Vercelli (Italy); III) Varieties sown and transplanted at two different times.

GROUP I. — Kukurio — Pelarda Précoce — Brasileño — Montesoro Précoce — Vialone nero and Vialone giallo, considered as a single variety — Bomba (Novelli Précoce, and Matusaska, were also tried, but they proved unsatisfactory and are not to be recommended to rice-growers on account of their low productivity).

As regards unit production, the above varieties are arranged in the preceding paragraph, in descending order, for they yield respectively: 6790 — 6100 — 5703 — 5294 — 4765 — 3646 kg. of paddy per hectare.

Brasileño is in process of degeneration. Montesoro Précoce, Pelarda Précoce, and Bomba are all remarkable for the fine quality of their grain.

GROUP II. — Précoce No. 6. — Isen — Dellarole — Mompel — Allorio — Onsen.

The three first varieties produced respectively 6101 — 5499 — 5102 kg. per hectare; the three last each produced about 3600 kg. per hectare; therefore their introduction is advisable. All these varieties must first be acclimatised.

GROUP III. — The Creppi, Originario 1, Originario 3 and Novelli Précoce varieties should be sown a little later than the others, for they are very early. Montesoro Précoce and Pelarda Précoce may be sown at the usual date.

\* \* \*

This article is followed by a comparative study of the results obtained from the different varieties in the experiment fields of Sueca and Albe-rique.

- 37.— **Moki Lima Beans (*Phaseolus lunatus*) in Egypt.** — FORBES, R. II., in *Bulletin No. 9 Sultanic Agricultural Society, Technical Section*, pp 1-22, tables 3, figs. 3. Cairo, 1921.

The semi-dwarf habit of growth, the non-twining vines, the endurance of arid conditions of climate and the markings of some of the seeds indicate that the Moki limas probably constitute a distinct group of horticultural varieties within the *Phaseolus lunatus* or Sieva classification. The two first characteristics permit cultivation as a field crop while the leguminous character of the plant and the nutritive value indicate a high food return with minimum drafts upon the soil. Of the colour variants, the White Moki is the most promising commercially.

About 4 months of warm weather are required to mature a crop of dry beans, they are therefore at an advantage in sub-tropical climates where a long season allows time for a succession of plantings.

According to the growth curves taken on monthly plantings made at Giza, stimulated vegetative growth is apparent during the more humid warm weather, July to October inclusive, although the best yields of beans are not necessarily associated with a rapid growth of vines. The marked drought resistant characteristic has also been demonstrated at Giza.

A small percentage only of the bloom develops pods, usually early in the blooming period and according to fertility of soil and space for development of the plant. Data as to the relation of blooms to pods in successive plantings are given and data relative to the setting of pods on several varieties of lima beans shows the highest setting for pods for the Moki lima possessing non-twining vines of medium length.

Owing to the long season (March to August) during which Moki limas may be planted in Lower Egypt, this crop is prospectively available for an unusual number of rotations. Following winter vegetables such as lettuce, cabbage, cauli flower, etc, it may be planted in March and harvested in July in time to be followed by quick maturing varieties of maize. Following broad beans it may be planted in May and harvested in September in time to be followed by wheat and barley. Following wheat and barley it may be planted in June and harvested in October, preceding cotton. It may be planted in July instead of maize and harvested in November preceding berseem (*Trifolium alexandrinum*) or cotton. Following winter rainfall it gives promise as a dry farming crop along the Mediterranean coast and in Palestine.

A description is given of the cultural methods employed in Egypt. Normally this leguminous crop should not require fertilisation under existing conditions, contributing to rather than drawing from the nitrogen supply; but until the required strain of *B. radiculicola* for this bean is available an application of 100 to 200 kg. of nitrates per feddan (1 feddan = 1.038 acres) will increase the yield.

However cultures of *B. radiculicola* from the U. S. Department of Agriculture have finally been established and abundant tubercles produced in experimental cultures with prospective improvement in yield and soil

value. The author gives an outline of 10 different attempts with cultures from various sources.

Insect pests and diseases have not thus far seriously menaced the plants or the crop. Grasshoppers (*Euprepocnemis plorans*), *Etiella zinckenella*, *Bruchus irseectus* have attacked the crop, but these attacks have been successfully controlled.

Under favourable conditions and with proper culture the crop should yield under irrigation 800 to 1000 kg. of good marketable beans in about 4 months time. This estimate approximates to the yield of lima bean in California, where the crop averages from 510 kg. per acre on ordinary land to 910 kg. in the best bean growing sections.

The cost of Moki lima culture based on experience at Balitim Farm has been estimated as follows, two estimates being submitted, for high and low costs of labour respectively. The total cost based on war prices with labour at 10 to 12 piastres per day (July 1920) is estimated at 13.84 £ Egyptian and the total cost based on lower prices with labour at 4 to 7 piastres per day is estimated at 10.32 £ Egyptian. The detailed cost of each cultural operation is notified. The profits per feddan of this culture, under various conditions may be estimated as follows:—

	600 kg 6 piastres per kg. £ (Egyptian)	800 kg 6 piastres per kg. £ (Egyptian)	600 kg 4 piastres per kg. £ (Egyptian)	800 kg 4 piastres per kg. £ (Egyptian)
Gross income . . .	36 00	48.00	24 00	32.00
Costs . . . . .	13 84	13 84	10.32	10.32
Net per feddan . . .	22.16	34 16	13 68	21 68

An analysis was made by PRESCOTT (Société Sultanique d'Agriculture) of samples collected from various sources including both original Arizona seed and successive crops grown in Egypt from this seed. According to the data presented the average of water free material in all Moki limas grown in Egypt, non tuberculous, showed 2.84 % nitrogen and 38.0 % starch (1918-1920). In approximately equal quantities these limas may be used in combination with starchy foods, especially maize (27.75 kg. of limas combined with 24.34 kg. of maize, assuming that the balanced ration for a sub-tropical population should average 1:5).

The author adds recipes which suggest the possibilities of using Moki limas as a food which should make a healthy substitute for meat in a hot climate.

38 - **Lentil-Growing in Brazil.** — *Chacaras e Quintas*, Vol XXIV, No. 3, pp. 207, fig 1. São Paulo, September 15, 1921.

Concise rules for the cultivation of the lentil (*Ervum Lens*), in Brazil are given in this paper. Agriculturists are advised to increase the acreage under this crop, as lentils fetch the good price of 14-15 *milreis* per sack (1 gold *milreis* at par = 2.83 fr.), and the exporters of Rio Grande do Sul are unable to satisfy all the demands made.



39 - **Yam Culture (*Dioscorea* spp.), in Porto Rico.** -- KINMAN, C. F., in *Porto Rico Agricultural Experiment Station, Bulletin No. 27*, pp. 2-22, pl. 6. Washington, 1921.

The yam is one of the important foods of Porto Rico where the climatic conditions favour its growth. It is well adapted to various types of soil, although giving the best results on heavy clay soils. This crop has however been very little cultivated in other countries and in certain cases is practically unknown. In view of the fact that high prices for foods are prevalent, and that yam is among the least expensive of food crops, the description of the general practices adopted in Porto Rico as regards this crop are worthy of attention. Experiments with a view to the introduction of new and improved varieties and methods of culture have been in progress at the Porto Rico Experiment Station for several years.

A description is given of the preparation of the land, and it is stated that ridges of well-stirred soil and vegetable matter should be made sufficiently large when planting to enable the roots to make a normal growth above the water level in the soil and above the firm subsoil. The plants should be placed from 1 to 2 ft. apart in these ridges, according to conditions peculiar to the root growth of each variety. Either entire or sections of roots may be planted, but the upper section has been found to give the most satisfactory results. Dipping in Bordeaux mixture was found to be an effective means of preventing decay of roots cut in pieces for seed. Applications of fertilisers did not result in sufficient increase in the crop to warrant their recommendation, but when used, none of the elements (nitrogen, phosphorus, potash) should be omitted. The table showing the average yield per hill, ridge planting, of 4 varieties of yams on fertilised and unfertilised plots confirms this statement.

Tests in cutting back the vines have demonstrated that vines should not be touched or injured if the best results are to be obtained. Where also the vine supports are insufficient there is a marked decrease from the normal yield.

Among the varieties commonly grown in Porto Rico, the one known as Guinea (var. *Dioscorea sativa*) is the most popular on account of its heavy yield, its high food value and its pleasant flavour. Other varieties here described in detail include the Potato Yam, (introduced from Africa), identified by WESTER as *D. aculeata*, Purple Ceylon, S. P. I. No. 31922 (var. *D. sativa*), S. P. I. No. 31920, *D. Chondrocarpa*, Agua (var. *D. alata*, introduced from New Guinea), Yellow Guinea (var. *D. Cavennensis*), and Mapuey Morado. The last is considered superior in flavour to any other yam, but the yield is low.

40 - **The Chemical Composition and Yield of Forage-Maize Cut at Different Stages, in Hungary.** -- WEISER, S., and SATTSCHKE, A. (Königl. ungar. tierphysiologischer Versuchs-station in Budapest), in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XC VII, Parts 1-2, pp. 111-130. Berlin, 1920.

FORAGE CROPS,  
MEADOWS  
AND PASTURES

In previous experiments carried out by the authors to determine the effect that the space left between the plants has upon the unit production

and nutritive value of forage-maize, the question arose as to the stage at which maize should be cut for silage, with a view to obtaining the heaviest crop per hectare (*Landwirtschaftliche Versuchs-Stationen*, Vol. LXXXI, p. 49, 1913).

In order to be able to answer this question, the authors made experiments in several places in Hungary for the purpose of discovering the chemical changes that take place in the plant, and the yield of crude nutritive substances per hectare from the time of the appearance of the male inflorescences.

Samples were taken at regular intervals until the plants withered and their leaves began to fall. A series of tables gives : 1) the composition of maize in its natural condition at the different dates of cutting and in the various localities — 2) the composition of the dry matter — 3) the water content of maize cut at different stages — 4) the amount of dry matter, and of each of its constituents, per surface unit obtained in every place, in the case respectively of a minimum, average and maximum crop; the increase taking place during maturation per 100 gm. of each of the constituents or of the total dry matter — 5) the percentage distribution of the total dry matter and of each of its constituents in the places where the maize was cultivated.

The water content of maize plants cut at the time of the appearance of the male inflorescences varied from 83.4 to 89 % and the average in 11 experiments was 87.23 %. KRIEGER gives 80.6 % as the mean water content of forage maize, but these researches show that 13 % is the maximum amount of water present in Hungarian maize. The loss of water sustained during maturation, and hence the increase in dry matter varies from one locality to another. On an average the daily increase in dry matter from the time of the appearance of the male inflorescences, until 20-76 days later was 0.24 % and the weekly increase 1.5 %. Green maize with an average dry matter content of 12.8 % at the moment of development of the male inflorescences, contained 20.6 % thirty days later and was so dry that it could no longer be fed as green forage.

The ash content of forage maize at the time the male inflorescences appeared varied from 0.66 to 1.5 %. In most of the varieties used in the experiments the mineral content of the plants showed no further increase from this date ; in 2 cases only out of 12 was there any noticeable increase. It is certain that the character of the soil and the nature of the fertiliser used determine the time at which the plant ceases to absorb mineral substances, but the absorption of these substances never proceeded parallel with the increase of dry matter. The dry matter ash content continued to rise until it reached the maximum, and then fell during 4 to 5 weeks, until it was about half the amount first observed : on an average from 7.37 % to 4.88 %.

The forage-maize protein content (both crude and pure), increased but little during the maturation process, and did not proceed *pari passu* with the increase in dry matter. The average of all the experiments was as follows.

	Crude protein	Pure protein
At the time of the appearance of the male inflorescences	1.07 %	0.86 %
In ripe maize . . . . .	1.26	1.03
In the dry matter on the appearance of the male inflorescences . . . . .	8.44	4.93
In the dry matter at maturity. . . . .	6.77	4.06

The ether extract content of a green plant at the time of the appearance of the male inflorescence was 0.48 %, and during the drying that accompanies maturation it rose to 0.76 %, whereas at the same time, the crude fat content of the dry matter fell from 3.76 to 2.40 %. It is certain that the composition of the crude fats also changes during this period, for often during the maturation of forage-maize, ears containing well-developed grains are produced, whereas on the other hand, the amount of chlorophyll progressively decreases.

In the ether extract of green maize, the authors only found 3 % of pure fats and 97 % of unsaponifiable matter, but in maize in process of ripening, the crude fat content continually increases while the non-fatty substances diminish.

The amount of crude fibre increases without intermission during the plant's development and until its complete maturation; on an average it rises from 3.29 to 6.35 %.

The fibre content of the dry matter nearly always remained constant; it was 26.7 %, on an average, at the time the first sample was taken, and 25.2 % when the second was gathered. This proves the incorrectness of the generally-received opinion that the fibre content of the dry matter present in maize is much larger some weeks after the development of the male inflorescences than at the date of their first appearance. The lignification of maize, which is connected with the drying accompanying maturation, cannot thus be explained by the increase in fibre, but must be attributed to other causes. It might be supposed to depend upon variations in the proportions between the 3 groups of substances composing crude fibre: cellulose, lignin and cutin, but the authors have found that there is no essential difference in the fibre composition of maize cut at different stages and therefore the cause of the process must be sought elsewhere.

The amount of nitrogen-free extract varies in green maize from 7.02 % to 15.7 %, and in the dry matter, from 54.75 % to 62.57 %. These extracts thus continue to increase during the maturation process.

The amount of dry matter produced by a plant varies from 5.03 gm. to 23.11 gm. at the time of the appearance of the male inflorescences; later the variations are still greater. There are also great differences in the number of plants per sq. metre and in the quantity of crude nutritive substances produced per sq. metre. In three experiments made at the same place (Jászberény), 282 — 301 — 182 gm. were obtained respectively from 100 gm. of dry matter in 59 days; at Debreczen, 648 gm. were obtained in 55 days; and at Kassa, 204 gm. in 60 days.

In the various localities the largest amount of dry matter was produced at different times after the appearance of the male inflorescences, and this is due to the different exposure of the fields and to the dissimilar climatic and cultural conditions. If the latter are favourable the amount of dry matter increases 4 to 5 times, otherwise it is only doubled. As the areas planted were of very limited extent, the results of these experiments are not absolutely applicable to practical work; they however show that after the male flowers have appeared, the plants continue growing for 7 to 8 weeks and the dry matter goes on increasing all this time. Maize for silage should thus be left standing as long after the appearance of the male inflorescences as is possible without its beginning to lignify (1 or 2 weeks). In this way twice to six times more dry matter is obtained than if the plants had been cut as soon as the tassels were formed, or a little earlier or later. The chief increase in dry matter takes place during the 8 to 20 days following the appearance of the male inflorescences.

From the beginning to the end of the experiment, the culm's growth in length and circumference always kept pace with the increase in the amount of dry matter per surface unit.

In the case of all the varieties used in the experiment the dry matter content was increased by the addition of the same substances. These consisted for the most part of carbohydrates, and to a considerable extent, of cellulose, that is to say, of the constituents which give maize its nutritive value.

The authors' experiments with oxen showed the digestibility coefficient of the nitrogen-free extracts, and of the cellulose to be respectively 76 %, and 59.90 %, whereas that of pure protein is only 55 %, so that the content in the latter element present in maize for ensilage is of no practical importance. The average percentage composition of the dry matter formed after the appearance of the male inflorescences was as follows: Ash 4.26 — Crude protein 3.60 — Pure protein 2.82 — Crude fat 1.98 — Fibre 25.56 — Nitrogen-free extracts 64.60.

As the composition of the crude fibre, like that of the nitrogen-free extracts does not perceptibly vary during maturation, the digestibility of ensilaged maize is practically independent of the time at which it is cut. The losses taking place during ensilage are also but little affected by the age of the maize used. From the point of view of forage use there is no objection to putting quite ripe maize in the silo. It should be cut at the time of the greatest production of dry matter and before any has been lost as a result of the falling of the leaves, etc.

41 - **Experiments in Growing Italian Rye-Grass (*Lolium italicum*), in Brazil.** —

DE SOUZA, Pedro P. (Director do Posto Zootécnico, Viamão, Rio Grande do Sul), in *Chacaras e Quintais*, Vol. XXIV, No. 3, pp. 193-194, figs 2 São Paulo, September

15, 1921

The author has tried growing both Italian rye-grass (*Lolium italicum*), as well as English rye grass (*Lolium perenne*), on the farm annexed to the « Posto zootécnico » of Viamão, Rio Grande do Sul (Brazil). In Europe,

the first plant is a biennial and the second a perennial, but in Brazil, neither stands longer than 8 or 9 months. At Viamao, *L. perenne* did not prove at all successful; *L. italicum* on the other hand did fairly well, giving 4 cuttings a year and producing 200 quintals and more per hectare.

From the results of these trials, the author gives the following approximate estimate (in *milreis* per hectare: 1 gold *milreis* = 2.832 fr. at par), of the cost of cultivating *L. italicum*, in Brazil.

EXPENSES.	
Ploughing . . . . .	36 <i>milreis</i>
Harrowing . . . . .	13 "
Fertilisers and manure (3 to 4 quintals of lime and of much-decomposed dung) . . . . .	361 "
Seed and sowing (40-50 <i>lirs</i> per hectare). . . . .	67 5 "
Cutting (the 3 first crops, the last is grazed) . . . . .	18 "
Transport . . . . .	27
Sundries . . . . .	21 7 "
Total expenses . . . . .	547 2 <i>milreis</i>

RECEIPTS	
203.6 quintals of green forage at 3 <i>milreis</i> per quintal . . . . .	790.8 <i>milreis</i>

42 - Cultivation of *Phalaris bulbosa* in Uruguay (1). — PUIG Y NATTINO, J., in *Revista pública oriental del Uruguay, Ministerio de Industrias, Inspección nacional de Ganadería y Agricultura, Boletín No. 40*, 32 pp., figs. 6. Montevideo, 1921

In 1917, the author, formerly Head of the Agricultural Laboratory of the National Service of Inspection of Stock-Breeding and Agriculture, began a series of experiments in growing *Phalaris bulbosa* (Toowoomba Canary Grass), which he has continued every year since that date. In this paper, he gives a detailed account of his work and also reproduces the letters of agriculturists in different parts of Uruguay who have also tried cultivating this forage plant and describe its various qualities — high yield (2 to 5 cuttings per annum), rapid growth, hardiness, drought resistance, etc.

A series of Tables is appended, giving the meteorological data — height attained by the plants at different ages (20 days after cutting, 20 to 24 cm., in some cases, in others, 50 to 84 cm.; at the time of flowering, 90 to 130 cm.) — the water consumed during growth at the various stages of development (from 19.1 % to 34.85 % of dry matter, about 20 % in the majority of cases) — the yield at each cutting, and the total yield for the three years of the experiment (minimum = 31.8 quintals of grass per hectare in one cutting per year; maximum 641.7 quintals of grass per hectare in 5 cuttings per year; generally from 200 to 300 quintals a year) — the average composition of the grass (means of 5 analyses; water 80 %; protein 2.13 %; ash 3.12 %; fats 0.77 %; crude fibre 4.38 %; nitrogen-free extracts 8.60 %; starch value 10.04; nutritive ratio 1: 3.4) and dry matter ratio as compared with the chief forage crops.

(1) See R. 1915, No. 1036; R. 1918, No. 296. (*Ed*)

43 - *Phragmites communis* as a Cattle Feed in Germany. — See No. 78 of this Review.

44 - **Lucerne in North Africa.** — TRABUT, in *Bulletin agricole de l'Algérie, Tunisie, Maroc*, Year 27, No. 8-9, pp. 129-131. Algiers, August-September, 1921. \*

The various authors who have studied the flora of N. Africa have stated that *Medicago sativa* is a wild growth.

POIRET also mentions *M. falcata* as occurring in Barbary, but it has since only been found in Morocco. It is possible that this author, who has chiefly studied plants in the Province of Constantine, has mistaken for *M. falcata* a *Medicago* with yellow flowers which afterwards received the name of *M. tunetana* Murbeck, 1897.

In 1873, URBAN, in his monograph on the genus, described the Algerian type, which is chiefly distinguished by its glandiform fruits, under the name of *M. getula*. In 1897, MURBECK recorded the *vulgaris* variety of *M. sativa*, but only as being cultivated here and there, but he mentions the variety *getula* Urban as occurring wild and describes the sub-species *M. tunetana* which is distinguished by its shorter, more rounded inflorescence, its pedicels becoming curved and bending back after the flower is withered, the more glandiform calyx, yellow, larger corolla, and glandiform fruits with 4.5 to 5.5 coils in the spiral, and a central orifice that is not easily distinguished.

MURBECK's statement is quite correct: *Medicago sativa vulgaris* is only to be found cultivated, or sometimes in process of becoming naturalised.

The wild lucerne, which is very common on the high plains and in the mountainous region of the East, is closely related to *M. getula* Urban, of which *M. tunetana* is a variety. This *Medicago* often grows on tufa covered with a thin layer of soil; it has a peculiarity that appears to have escaped the notice of botanists: the dense tufts pass downwards into numerous, often very long, underground rhizomes.

This character has never been observed in cultivated *Medicago sativa*.

The author has grown *M. getula* for several years at the Algiers Botanic Station, where it propagated itself by means of its rhizomes which formed an extensive matted growth. When raised from seed from the high plains of Numidia and from the mountains, this species proved to have fixed characters, only showing variation in the colour of its flowers, which were blue, pink, yellow and also white. Even in good soil, it did not grow well, and no large forage crop would be obtained from it.

In looking for the origin of *Medicago sativa*, the author came across references to *M. cancellata* M. B., *M. prostrata* Jacq., *M. Coerulea* Ledeb *M. Contorta* Gilib, etc. as varieties growing wild in S. Russia and Western Asia which are very nearly akin to, if not identical with *M. getula* and *M. tunetana* from North Africa and raises the question whether it is really a wild growth at all. Probably it is a case of a combination of two wild forms, such as usually occurs with most cultivated plants? If this is the explanation, he thinks that *M. falcata* is certainly concerned, for its characters are

seen in many of the plants composing the best lucerne crops, and there is a whole series of half-wild forms connecting *Medicago sativa* with *M. falcata* for which reason many authors include them both in the same species.

For the present the author is of opinion, that the name *M. getula* should be reserved for wild *Medicago*, and the name *M. sativa* used solely for the cultivated forms.

*M. tuncetana* Murb. is to be distinguished as a secondary form and is the most distant from the *sativa* type.

In the *Flore de France*, ROUY connects *Medicago getula* with *M. glomerata* Balb., and describes an *M. cirtensis* Rouy which is simply *M. tuncetana*. MURBECK'S name, seeing it has two years' priority, should be retained.

In the district of Sétif, where lucerne is cultivated, hybridisation certainly takes place, as seems to be shown by the observations of M. W. OLIVER, of the Bureau of Plant Industry, Washington, for in a sowing from Sétif he was able to distinguish fifty kinds of lucerne seed.

These derivatives of *M. getula* may become useful on account of their cold resistance, as the author saw *M. tuncetana* growing at an altitude of 2000 m. in the Aurès massif in Chelia. Their power of spreading by means of rhizomes may also render these lucernes valuable for making permanent pastures on poor, shallow soils.

The large number of varieties of cultivated lucerne grown in the Algiers Botanic Gardens have made it possible to discover many fixed forms with quite different characters. At the present time, the efforts of the breeder are devoted to the selection of a Peru lucerne that shoots much earlier than the so-called Provence variety. It also goes on growing so much later into the autumn, that a permanent crop could probably be obtained in the coast districts.

For the elevated plains where the winter is more severe, hybrids between *Medicago getula* and cultivated lucerne, preferably Peru lucerne, are the most suitable.

It is necessary that crosses should be made between *Medicago getula* and *Medicago falcata* for the purpose of obtaining a hardy lucerne suited to the climate of the High Plateaux.

RYF, at Sétif, has already made an attempt at acclimatising a variety of lucerne capable of thriving without irrigation. The seed collected in the neighbourhood came, at least to some extent, from hybrids between introduced lucerne and the wild variety which grows plentifully in the district. In order, however, to obtain any results of practical utility, it would be necessary to study the numerous derived forms, to isolate them and breed them systematically, a work which can only be done on the spot and by an expert in genetics.

45 - **Cultivation of Sulla in Eritrea.** -- Ministero delle Colonie, Ufficio Affari Economici, *Bollettino di Informazioni*, Vol. IX, Nos. 5-6, p. 278. Rome, May-June, 1921.

Sulla was introduced into the Colony of Eritrea by Baron FRANCHETTI'S special Colonising Mission (June 1890 - February 1895), but the first at-

tempts at cultivating this plant on the plateau were very unsuccessful. Now however it is grown without difficulty, for it shoots well, is resistant to the most prolonged drought, and yields an abundant supply of excellent forage. The Italian colonists sow sulla both on the plateau, and also half-way up the slopes. Owing to its deep, tenacious roots, this plant is able to bind the soil thus preventing the formation of the deep cracks that otherwise result from the heavy rains and the soil evaporation.

- 46 - *Atriplex semibaccata*, a Good Forage Plant for Chile (1). — SARABIA, A. G. (Agrónomo regional de la 1<sup>ra</sup> zona), in *Boletín de la Sociedad agrícola del Norte*, Vol. II, No. 5, pp. 81-82. La Serena, May 1921.

According to the author, *Atriplex semibaccata* resists the dryness of the soil better than any of the other forage plants introduced into Chile, and therefore is spreading rapidly through the country. On farms where it is grown, double the number of cattle can be kept per unit surface area of natural pasture. A meadow of *A. semibaccata* stands from 6 to 10 years in North Chile. Its drought resistance is due to its long, well developed roots. It bears seed from the 1<sup>st</sup> or 2<sup>nd</sup> year of planting (as much as 1 kg. per bush may be obtained).

This Chenopodiaceae (known popularly as "pasto salado") requires damp air, and only thrives on the coast zone, on a belt 30 to 40 kilometres in width. It is susceptible to frost, but is not exacting as to soil, although naturally the finest crops are grown on the most fertile land.

*A. semibaccata* is a forage eaten by all stock, with the exception of horses; mules and donkeys will take it, and cattle, sheep and goats consume it with avidity.

- 47 - Pasturage in the Fiji Islands. See No. 82 of this Review.

#### FIBRE CROPS

- 48 - Cotton Cultivation in Korea. — *The Textile Recorder*, Vol. XXXIX, No. 461, p. 74. Manchester, November 15, 1921.

According to the statistics published in a recent number of the Official Gazette of the Government General of Korea, the growth of cotton plants up to the end of June this year, both before and after budding, has on the whole been good, owing to favourable weather. The area in the 10 provinces under cultivation amounted to 263 802 acres of Upland cotton, and 98 748 acres of native cotton, showing a total increase of 14 092 acres compared with the 1920 figures.

From experiments made on Government model farms it has been reported that the American variety known as "King's Improved" (*Gossypium herbaceum*) is the best adapted to the south of Korea and yields better results in spinning than the native variety. The area devoted to the cultivation of the foreign variety has steadily increased from 15 791 acres in 1912 to 263 802 acres in 1921, while the native variety has shown a small decline from 109 382 acres to 98 748 acres.

During 1920 there was exported 63 046 lb. of cotton in the seed, val-

(1) See R. July 1921, No. 705; R. August 1921, No. 807. (Ed.)



ued at 2466 yen (1 yen = 2s at par), and 8 764 871 lb. of ginned cotton, valued at 6 000 786 yen.

Practically the entire amount was exported to Japan. Although the industry is developing, Korea is still dependent on supplies from abroad for the greater part of her cotton goods.

49 - **The Past and Future of Olive-Growing in Libya.** — DE CILLIS E., in *Ministero delle Colonie, Ufficio Affari Economici, Bollettino di Informazioni*, Vol IX, Nos. 5-6, pp. 271-275 Rome, May-June 1921.

PLANTS  
YIELDING OILS  
DYES TANNINS  
ETC.

Libya is a country eminently suited to the cultivation of the olive, and formerly this industry flourished side by side with sheep-rearing and cereal growing, as is proved by the vestiges of Roman olive-presses that are to be seen on an area of thousands of hectares in the hinterland of Homs (the ancient *Leptis Magna*); Cyrenaica is in equally fortunate circumstances as regards the cultivation of this valuable tree.

Along the Tripolitan coast zone, stretch numerous oases growing some 142 000 olive trees; in the oases of Tripoli alone (Menscia, Sahel, Tagiura, Gurgi and Gargaresc), there are 18 907 young trees and 39 045 adult, giving a total of 57 952. There are 40 000 olive-trees in the "genanât" (dry gardens) of the district of Homs; 130 000 in the splendid "gabe" (specialised olive gardens), of Msellata; 96 000 in Gârian; 81 500 at Jêfrem; 80 000 at Fassato; 35 000 at Nahût, 7000 at Orfella. The number of olive trees in the whole of Tripolitania may be estimated at over 600 000. At Homs and Msellata, where scientific dry-farming methods are adopted a more or less abundant crop is obtained annually, even when the rainfall has been very scanty. In good years, enough olives are grown at Msellata alone to supply all Libya. In 1918, 12 000 hectolitres of oil were produced in the oases of Tripoli, and it is calculated that the 1920 output will reach the same figure.

In Cyrenaica, there are some olive-trees in the irrigated gardens of Bengasi and Derna and in the dry gardens of el-Merg, there are also a few scattered specimens in the gardens of the interior, at Messa, Es, Ain-Mara and el-Gubba, but in all the woods of the plateau, wild olive trees are to be found. On the terraces of Cyrene (especially on the slopes of the "uidian" where traces of the stepped structures made by the ancient Greek colonists are clearly visible) and on the plateau dominating Derna, are still to be seen olive trees that have been allowed to run wild and receive no care from the natives. The passing Arabs gather the fruit and take it to the 2 oil-factories set up by Italians at Derna where the oil made is equal in quality to the finest product of Southern Italy.

The whole of North Libya is adapted to olive cultivation, with the exception of the dune zone, which is, however, of very limited extent. Even this does not represent the whole of the olive-growing region, the trees thrive and bear fruit in the "uidian" of the pre-desert district, as well as in Wady Soffegin, at Zauia Msus in Tripolitania, and in Wady Msus in Cyrenaica. At the gates of the Libyan Desert, in the desolate region of Balte, in the midst of the Wady Ramba (torrent of sand), the author

has found an olive-tree marking the extreme southern limit of the species, 100 kilometers from the coast

If we estimate the superficial area of N. Libya at 79 000 sq. kilometers there remain, after subtracting the waste ground (reckoning this at  $\frac{1}{3}$ , which is however a rather high figure), 53 000 sq. kilometers on which the olive-tree thrives. By adopting dry-farming methods, 1 million hectares could be planted with 20 trees per hectare; this would give 20 000 000 trees, enough to supply the whole of Libya.

That the cultivation of olive-trees is both profitable and remunerative is shown by the author who gives a brief account of the history of the Sialine land of Tunisia in the district of Sfax (the latter, taking it as a whole, is the region least suited to the olive). There are 160 000 hectares of Sialine land (viz. property taken away from the family of Siala and confiscated by the Bey of Tunis), which have been turned into olive-gardens under the "mougharsa" system of tenure; this is the system obtaining among the Arabs and it is much liked by the natives. According to the contract, the owner hands over the land to the agriculturist who binds himself to lay out a garden, or make a "gaba" (plantation of trees). The agriculturist provides all the necessary capital and labour, or else borrows it from the land owner. He enjoys all the return from the land, without paying any rent, until the trees begin to bear (which in the case of olives is generally 12 years). Then the land is divided into two equal portions, one half, which has been much improved, goes to the owner, and the other becomes the absolute property of the agriculturist who has planted it

In 1893, the French Government put up the Sialine land for sale, in lots, offering it to French citizens at 10 francs per hectare on the condition of its being planted with olive-trees. The land was bought and at once made over to natives under the "mougharsa" contract. Thus, between 1893 and 1907, 2 350 000 olive-trees were planted in the Sfax district; at the present time, their number has increased to 3 500 000. From the figures carefully obtained on the spot by the author, it would appear that at pre-War rates, the expenses per hectare of olive-gardens amounted in 10 years to 198.90 lire; each tree has therefore cost 11.56 lire and in 20 years (when the olive-trees are in full bearing) will have cost 18.53 lire, not counting any return obtained in the meantime. The average value of each tree with the ground it occupies is then reckoned at 50 lire, that is to say, at 3 times the amount expended. On adding to the price of the land (10 lire per hectare), double that sum for making wells, building houses, general expenses, interest for 20 years, etc., we get, with an outlay of 30 lire per hectare, the sum of 430 lire for the 95 hectares, this represents a gain of 1433 % for the landowner. The native by expending 135.50 lire gains 317 %. Finally, at the 20th year, he obtains a net return of 4.12 lire per tree, namely about 8 % of the value of the land.

In Libya, there are however no Sialine lands. All the land is in the hands of the natives, either in the form of private property ("mulch") or of collective property ("mètruke") This might appear a great objec-

tion to the "mougharsa" contract, but it is not, for the clauses are simply reversed, the native taking the place of the owner, and the French colonist, who possesses the capital necessary for planting, becoming the "mougharisa". The Libyan landowners or the Arab tribe would be perfectly competent and willing to assume the duties devolving upon them, and examples of such an arrangement are not wanting in either Tripolitania or Cyrenaica. By this means (with pre-War prices), the colonist would be sure, not only of obtaining compound interest, but also of seeing his capital trebled in 20 years.

50 - **Notes on Indigo<sup>(1)</sup>, Effect of Phosphate Manures and General Conditions Affecting the Yield and Quality of Seed in India** (1). — DAVIS, W. A. (Indigo Research Chemist to Government of India) — I. Effect of Superphosphate Manuring on the Yield and Quality of the Indigo Plant. — II. Effect of Manuring with Superphosphate and Sannai (*Crotalaria juncea*), on the Yield of Crops on Indigo Planters' Estates in Bihar, especially on Rabi Crops in Season 1918-19 — III. Conditions affecting the Quality of the Java Indigo Plant (Leaf Yield and Richness of the Leaf in Indigotin) — IV. ARKINS, W. R. G. (Indigo Botanist). Note on the Deterioration of Indigo Seed during Storing, in *Agricultural Research Institute, Pusa, India Publication*, No. 4, pp. 19 + 2 tables, 1918; No. 6, pp. 30, 1920; No. 7, pp. 33 + 9 tables, 1920, and No. 10, pp. 9 + 7 tables, 1921. Calcutta

I-II. — EFFECT OF SUPERPHOSPHATE MANURING ON INDIGO PLANTS. — That the principal factor in determining high yields of indigo (not merely of green plants per acre but the actual produce forthcoming) lies in the nature of the available foodstuff *in the soil* at the time the plant is grown appears clear from the results here reported from India.

A Table gives the yield of plant per acre, the weight of cake indigo obtained per acre, the yield of cake indigo per 100 maunds of plant, and the weight of green plants required to produce 1 maund of cake indigo (1 maund = 82.27 lb.) under different conditions of manurial treatment.

The following points stand out very clearly as regards the effect of conditions of growth on the quality and yield of produce:—

1) The plants grown on land treated with superphosphate and sannai (*Crotalaria juncea*) in June, were of a very much better quality than those grown on more fertile land which had received no manure, but was left fallow for 12 months — as shown by the yield per 100 maunds of plant being 13 seers 15 chataks (1 seer = 2.2 lb., 1 chatak = 2 oz.) as against 10 seers, 14 chataks. Thus, although the actual yield of plants per acre was slightly less (94 maunds, 6 chataks as against 95 maunds, 12 chataks), the actual produce of indigo per acre was considerably higher (13 seers, 2 chataks as against 10 seers, 5 chataks). By the first week in July not only was the actual yield of green plants per acre far higher in the case of the super-treated land but the quality was also far superior, so that the yield of cake indigo reached the phenomenal value of 32 seers, 4 chataks per acre for a single cutting. This value is from 2 to 3 times

(1) See R. Oct. 1921, No. 1057 and No. 101 of this *Revue*. (Ed)

greater than that obtained from plants grown on "seeded" land (*i. e.* land where refuse from steeping vats has been applied).

The figures given for the average yield of cake indigo per acre are at variance with the idea frequently held by planters that the low yields of indigo recently obtained on most estates are due to deterioration of the Java indigo plant. It is now evident that enormous yields of indigo can be obtained even in a year of unfavourable climatic conditions and with the existing Java plant provided that soil conditions are favourable. The author estimates that the majority of lands in Bihar can by steady manuring for a few years be made to yield 20 to 30 seers of indigo per acre in the course of two harvests.

From the results at Moniara it appears that a combination of green-manuring with sannai and superphosphate is an ideal one to ensure not only a high yield of plant but also high quality.

These results were confirmed in 1919 on various estates and in Bihar the treatment with super and sannai more than doubled the yield of green plant (141  $\frac{1}{2}$  maunds per bigha) (1 bigha = 0.87 acre). The yield of cake indigo per bigha was also double on the manured land than on the rest of the cultivation.

**EFFECT OF MANURIAL TREATMENT WITH SUPERPHOSPHATE ON THE YIELD OF RABI CROPS (*i. e.* SPRING CROPS).** — Some extraordinary increases have been reported from Champaran (Bengal) by the use of superphosphate alone and very poor lands which as a general rule failed to yield good crops, have given as much as 15 to 24 maunds of oats per acre. The application of superphosphate in conjunction with a green crop such as *Crotalaria juncea*, etc. has also brought about considerable increases. The soils in this case are very light and it is a remarkable fact that it is in these very light, well drained soils where aeration is most perfect that superphosphate has given the most striking results. In certain parts of India *e. g.* the Muzafferpur, Darbhanga and Monghyr Districts, there is a very marked deficiency of organic matter; hence the necessity for the addition of green manure. In such soils of which the Pusa soils may be taken as representative, superphosphate applied alone produces only about half the increase of crop which is obtained by the combination of green manure and super-phosphate.

To ascertain the actual manurial requirements of each estate it will be necessary for planters to make trials themselves with super alone or combined with organic manure for indigo and rabi crops. Results will be reported next year. The considerable increases of both indigo and cereal crops shown to be possible by the past trials makes the future position of natural indigo very hopeful.

**III. — CONDITIONS AFFECTING THE QUALITY OF THE JAVA INDIGO PLANT.** — Trials have been made at Pusa to ascertain the effect of growing a cover crop (such as wheat) with indigo, on the quality and yield of the indigo crop. Results already obtained throw considerable light on the conditions which determine high quality in the plant and the relationship existing between soil conditions on the one hand, and richness of the plant in indigotin on the other.

The indigo which follows the wheat grew slowly at first, probably owing to the removal of moisture from the soil by the wheat crop ; but after the monsoon broke it was found to develop well and finally to give an exceptionally high quality plant with a high percentage of indigotin.

Data are given showing the yields and analyses of Java plants from the Punjab area in 1919, and the following figures show the comparison in quality of plants : B. 9 grown on one section with wheat as a cover crop and B. 16 indigo plants grown continuously ; — Total for season : Plants per acre : 114 maunds 8 seers compared with 106 maunds ; Possible yield of 60 % cake indigo, 28.97 seers and 13.90 seers respectively.

The percentage of indigotin in the leaf appears to be determined mainly by the amount of readily available nitrogen in the soil ; when this is high, the indigotin content of the plant is low, *e. g.* B. 9 has a decidedly lower value for nitrogen than most of the indigo soils in Bihar and B. 16 is unusually rich in nitrogen.

Trials have demonstrated that the essential conditions to ensure the good growth of high quality indigo plants in addition to the above mentioned points are :— *a*) a good supply of carbohydrates in the form of decomposable organic matter ; *b*) a good supply of soluble phosphate in the soil to stimulate favourable growth and activity of the nodule bacteria (See I and II). In the case of indigo the problem is to supply organic matter without at the same time increasing the readily available nitrogen. If organic manure is added, the author considers that the indigo should not be grown until the nitrogen has been reduced by taking out other crops, otherwise although a large crop of indigo may be obtained the indigotin produced will be low. Recommendations are made to grow indigo with a cover crop (wheat, mustard or flax, etc.) after manuring with *Crotalaria juncea* and super.

IV. — DETERIORATION OF INDIGO SEED DURING STORING. — Experiments have been made with a view to the discovery of the best method of storing Java seed. On testing the various samples after the rains the following germination capacities were obtained : — Seed treated with acid : closed bottle, 84 % ; open box nil. Untreated seed ; closed bottle 8 % without treatment, 90 % after treatment ; canvas bag, 74 % after treatment ; Buried in " bhoosa " 77 % after treatment, open box 60 % after treatment. Results showed that treated seed can only be kept over the rains in sealed vessels ; untreated seed can be kept in dry sacks with safety. The loss of about 15 % in germination capacity which the untreated sample stored in a sack appears to show represents a proportion of the unripe seeds in the sample.

An attempt was made to correlate the germination capacity and colour by taking 100 seeds at random and ascertaining the percentage of light and dark coloured seeds, also the number of each that germinated and the total germination, those only germinating within 2 days being included in the accompanying data. The usual treatment with acid was given and some seeds required repeated treatment ; these specially resistant seeds in most cases failed to germinate. — Hence the importance of a thorough

treatment with acid. The usual time of treatment is 20 to 30 minutes; but it should be varied according to temperature (the chemical reaction being approximately doubled by every increase of  $10^{\circ}$  C).

After observations made with reference to the shape, swelling of seed in water, weight and comparative rate of germination according to the colour of the seed, it appears fully established that the change in colour which the seeds undergo is a good indication of their condition, a marked change denoting a loss of vigour amounting in many cases to complete failure to germinate. Elongated seed seems to perish more rapidly than plump round seeds.

Among the samples examined, those of high seed weight were superior to those of low weight with respect to their retention of germinative vigour. Hence the importance of the seed being well matured before gathering.

It is suggested that planters should vary the usual time of acid treatment to find the best time for the given seed sample and temperature.

**RUBBER, GUM  
AND  
RESIN PLANTS**

- 51 - **Notes on Alternate Tapping of Hevea in Indo-China.** — GIRARD, E. (Administrateur Délégué des Plantations de Suzannah et An-Lôc, Ancien Président p. i., du Syndicat des Planteurs de Caoutchouc de l'Indochine), in *Bulletin des Caoutchoucs de l'Institut Colonial de Marseille*, No. 1, pp. 2-15. Marseilles, 1921.

Results obtained from a series of experiments covering a period of 6 to 7 years conducted in Indo-China with a view to ascertaining the most productive and the most economic form of tapping. It appears to be clearly advantageous to allow comparatively long intervals between the actual tappings.

Dealing first with the alternate month system, the following conclusions have been drawn from these experiments :— 1) That the decrease in yield varying according to the condition of the trees at the time alternate tapping commences, may be as much as 80 % during the first months (comparing each month separately) and about 50 % for the entire first year of alternation. This reduction in yield is, however, counterbalanced by the economy effected as regards manual labour, and the fact that the bark is always in fresh condition preparatory to tapping; — a point which is not habitually the case when the daily tapping system is adopted. The lack of manual labour is a serious question in certain districts and matters may evidently be rectified by adopting this alternate month system. If this method does not prove sufficient to meet the labour situation, it has been demonstrated as shown by interesting data referring to a long series of experiments, that 3 groups may be given to each gang, trees being tapped only once every third month; both in this case and the alternate month system, the weekly one-day rest can easily be allowed to the labourers and this is advantageous from the point of view of physical strength, choice of coolies, etc.

2) The decrease in yield observed during the first years is considerably less before the close of the second year when it may be estimated at only 15 to 20 %.

Apart from general experimentation over a wide area 5 plots of equal

TABLE I — *Comparison between various forms of tapping 1918-20.*

Lot	No. of trees tapped				Yield per hectare per day of tapping				Yield per tap per tree				Consumption of bark		Number of men employed daily for tapping			
	1918	1919	1920	1918	1919	1920	kg	kg	kg	kg	kg	kg	1918	1919	1920	1918	1919	1920
No I (1)	1896	1019	2331	146	253	512	185	6335	11562	1/2 circum to 0.20 height	1/2 circum to 0.18 height	1/2 circum to 0.15 height	2	2	2	2	2	2
No II (2)	2509	3092	3083	339	120	600	2137	2501	3503	1/5 circum to 0.90 height	1/5 circum to 0.45 height	1/5 circum to 0.45 height	9 hectares per man on 1 month tapping to 2 months repose system	6	6	6	6	6
Nos. III, IV, V (3)	8669	8920	8880	258	208	571	3225	3617	7220	1/5 circum to 0.45 height	1/5 circum to 0.25 height	1/5 circum to 0.225 height	3	3	3	3	3	3

(1) No I — Tapping 3 times per month at intervals of 10 days, and from Aug. 1919 onwards tapped every 3 months.

(2) No. II. — Control; tapping daily.

(3) Nos III, IV, V — Tapping alternate weeks, twice a month (2 weeks between each), and from Aug. 1919 onwards, every other month.

superficies were planted with *Hevea* of similar origin and age and at regular intervals. The soil and treatment were identical in every case. The data in the annexed table show the results obtained; it is interesting to note also from the economical standpoint the number of workmen employed for tapping.

- 52 - **Possibility of Cultivating the Camphor Tree at Porto-Rico.** — LEGRAND, J. F., in *Revista de Agricultura de Puerto Rico*, Vol. VI, No. 6, pp. 7-8, fig. 1. San Juan, P. R., 1921.

The author mentions the presence of some fine camphor trees on the agricultural farm annexed to the University of Porto Rico. The perfect acclimatisation of the existing specimens proves that these valuable trees can be grown in the island. The author advises that they should be cultivated on a large scale, seeing that large profits could be realised by this means.

**STIMULANT,  
AROMATIC,  
NARCOTIC AND  
MEDICINAL  
PLANTS**

- 53 - **A New Method of Harvesting Coffee.** — DE AMARAL CASTRO, J., in *Chacaras e Quintas*, Vol. XXIV, No. 3, pp. 195-196. São Paulo, September 15, 1921.

The Author suggests that coffee should be harvested by shaking the shrubs and afterwards collecting the berries that fall to the ground. He considers this a better method than the one hitherto adopted, viz. passing the hands over the little branches and thus detaching the fruit, as it prevents any injury to the buds upon which the next crop depends and also economises labour. The fallen berries must be collected in 2 or 3 months, at the latest, that is to say, before there is any risk of their becoming spoilt.

- 54 - **The Santalaceae and Sandal-Wood: Distribution and Uses** (1). — GROUT, C., in *La Parfumerie Moderne*, Year XIV, No. 9, pp. 196-197. Lyons, September 1921.

The genus *Santalum* is the typical genus of the family of the Santalaceae which is characterised by a 3-5 lobed perianth, the same number of opposite stamens, and bilocular, longitudinally dehiscent anthers. The ovary is inferior, adherent and unilocular, with 2-5 ovules. The fruit is monospermous and surmounted by a persistent limb.

The family of the Santalaceae is represented in France by a single species, *Osyris alba*. This is a low-growing shrub that may attain the height of one metre and is found growing on the sandy, dry soils of the olive region where it is known by the name of "Rouvet". It has striated branches, persistent, pointed leaves with a single vein. Its flowers are dioecious, small, and yellowish; they are situated at the apex of the branches, the male flowers growing in clusters, while the female blossoms are solitary. The fruit is red and of the size of a pea.

Another species (*Osyris tenuifolium*), has thin leaves; it furnishes a wood that is very similar to the product of *Santalum album* (the sandal-

(1) See Jan. 1918, No. 2, p. 22. Production of Sandal-Wood Oil in Mysore, British India. (Ed.)



wood tree), and is an article of some commerce. It is exported chiefly from Zanzibar.

*Osyris tenuifolium* is a shrub or small tree, growing freely in the mountainous districts of East Africa. Its flowers, like those of *Os. album*, have free sepals crowning an inferior ovary. The fruits are drupes.

The sandal-wood of antiquity come from *Santalum album*. This is a small tree some ten metres in height, of very bushy habit. Its leaves are persistent, and it has small brownish flowers and reddish fruits. This plant is found in India, Malaysia, and China, at heights varying from 600 to 900 metres. The sap-wood is white, thick and soft, the heart-wood being of a brownish-yellow colour with bitter taste and a strong clinging smell. This wood is close-grained, very dense and difficult to split. The decorticated trunks of commerce have a very pleasant odour of musk, rose and lemon. They should contain little, if any, sap-wood, and are rich in essential oil. The heart-wood furnishes the lemon-coloured, or yellow sandal-wood whereas the sap-wood is the white sandal-wood.

The sandal-wood oil of India comes only from *Santalum myrtifolium*, *S. insulare*, *S. Homei*, *S. Yasi*, shrubs growing in India or the Sunda Archipelago.

*Santalum Pressianum* which grows in South Australia, where it is known under the name of Quandong, furnishes a dark-brown, very heavy wood with a fragrant odour resembling that of the rose. It yield 5 % of cherry-red, viscous liquid and produces edible fruit.

*Santalum cygnorum*, or *Fusanus spicatus*, is found in West Australia, and *Santalum Yasi* in the Viti Islands.

A wood very similar to that of *Santalum album* comes from the Ha-soranto of Madagascar.

The red sandal-wood tree of India is *Pterocarpus indicus* which is a member of the Papilionaceae (Leguminosae). It is also found in Burma, Annam, Cochin-China and the Andaman Isles, and is a tree of considerable growth, but no great height (10 m. at the most). The wood is red, very hard and heavy (average density 1.05); it furnishes an astringent colouring matter, now little used.

The red sandal-wood of Africa comes from *Pterocarpus santalinoides*, *angolenis*, or *tinctorius*. It is coarser-grained, but more brilliant in colour than the Indian product, and is used in dyeing.

The red wood of Kodar, or Calliatour wood, is the product of *Pterocarpus santalinus*. This tree is found in Southern India and conveyed to the Coromandel coast. The alburnum is thin and light in colour, the duramen is a more or less dark-red, often almost black. It was formerly much prized for dyeing. Now it is used for carving, the idols of the natives being fashioned from the wood of the roots.

The Padouk of Burma, is *Pterocarpus macrocarpus*, its wood is hard, and varies in colour from a light yellowish-red to a dark brick-red.

The red wood of the Andaman Isles comes from *Pterocarpus dalbergioides*. It is very resistant and durable; its colour ranges from dark-red to brown.

The Kino *Pterocarpus* (*Pterocarpus marsupium*) is the source of the gum called Kino. The tree is found in Southern India and Ceylon. The colour of the wood varies from yellow to a brownish grey ; darker coloured bands run across the trunk of the tree. The wood is very hard and durable.

*Pterocarpus Michelei* growing in Argentina, (Iba-ra du Chaco), differ from the other species in furnishing only a somewhat light wood that does not last long.

*Pterocarpus cambodianus* (Dom Khtnongen-Kmer), is found in Cambodia. Its wood is reddish-brown and rather heavy.

The red mahogany of the Congo is *Pterocarpus erinaceus* ; this tree is said to produce the Kino of Africa and Gambia and is found in tropical Africa. It has a hard wood with twisted fibres.

The Gabon Padouk is *Pterocarpus Soyauxii*. Its alburnum is rose-coloured and thick. The duramen is semi-hard and of a coral-red with darker veins ; it becomes very brown on exposure to the air. This wood is used in dyeing.

The red sandal-wood of the Antilles, or soft Coral wood, is furnished by two species of tree ; *Pterocarpus draco* and *Pterocarpus gummifer*, it is lighter and less dark in colour than the ordinary red sandal-wood.

The hardest woods of the various species of *Pterocarpus* offer an extraordinary amount of resistance to the attacks of insects, especially to those of termites. It is this very quality, in conjunction with its pleasant smell, that has caused the sandal wood of *Santalum album* to be highly prized from the most remote antiquity. It is even spoken of in ancient Chinese and Sanskrit books. Seventeen hundred years before the Christian era, the Egyptians sent to Yemen for sandal-wood. The Buddhists used it for making religious statues and for the decoration of their temples ; the woods of different species of *Pterocarpus* are still sometimes employed for similar purposes.

From ancient times until our own days, several authors have written about sandal-wood. In the XV<sup>th</sup> century, one of them described three kinds, a white, a yellow, and a red. Another, writing in 1511, stated that the white and the yellow sandal-woods came from Malabar and were 10 times more valuable than the red variety.

Sandal-wood oil has only comparatively recently been extracted and studied. Probably however it has been known in Ceylon since the IX<sup>th</sup> century and used in embalming the bodies of important persons.

At the present time the Hindoos and Chinese still use sandal wood for burning at religious ceremonies, or rites connected with the worship of the dead and a large quantity of the Indian product is thus employed.

Sandal-wood is also much in request for carving, the manufacture of frames, boxes, coffers inlaid with ivory and for coffins. It is one of the four sudorific woods (the others being sassafras, China root and guaiacum).

In South India, *Santalum album* chiefly grows at an altitude of 2000 or 3000 ft. in fine soil mixed with gravel or in red clay, but these soils must be very well drained and aerated. The tree will grow quite well

at lower altitudes, though its essential oil content gradually decreases; at 700 ft. the trees are still vigorous, but the wood has no smell.

On fairly fertile soil, where the growth of the tree is slow, the wood is more scented than on rich soil which stimulates its development. Owing however to the greater size of the trees, it is possible to obtain more essential oil per acre in the second case than in the first.

In order for *Santalum album* to grow satisfactorily the ground must be slightly shaded by bushes and the climate fairly damp.

This tree flourished in hedges, or thinly growing forests. In fact, it will only grow in the neighbourhood of other trees or shrubs, which has caused it to be regarded as a parasite.

*Santalum album* can be exploited as soon as the scented portion of the wood is well developed. This occurs when the tree has a girth of 60 cm. to 1 m., and is between 40 and 50 years old. From this time, the tree may be expected to increase in girth 20 cm. in 10 years.

Live-stock and game do much damage to forests of *S. album* by browsing on its leaves. These animals however also crop the grass thereby diminishing the danger of fires which are of frequent occurrence. Thefts of wood are very common; the natives cut the trees before they are sold, in order to find out the perfume content of the wood.

*Santalum album* is reproduced from its fruits; as it bears a liberal supply of the latter, there are always enough for the purpose, in spite of their being much sought after by birds, especially crows. There can be no question of propagation from shoots; for the roots are as much an article of commerce as the aerial woods. The seedlings are often suffocated by grass or climbing plants.

In India, most of the sandal-wood is produced in the province of Mysore, where there is a factory which possesses the sole right of distilling all the wood of the Province and is able to make purchases of wood in other centres.

*Santalum album* is beginning to be exploited in Tonkin, in the Province of Quang-Yen.

*Santalum cygnorum* from Western Australia, furnishes the "Swan River Santal Wood" that is put on the market at Singapore and applied to the same uses as the wood of *Sant. album*.

The Hasoranto of Madagascar (*Santalina madagascariensis*, belonging to the family of the Rubiaceae), produces an essential oil of good quality.

Sandal-wood oil is obtained from these woods by distillation. The yield is very variable, ranging from 1.5 to 5 %. The oil is of a more, or less light shade of yellow, its smell is faint, but clinging, resembling the scent of the rose; it has a disagreeable pungent flavour.

In this essential oil have been found: ethers; two levogyric alcohols (santalols), having the formula  $C_{15}H_{25}OH$ ; one aldehyde (santalal), with the formula  $C_{15}H_{34}O$ ; one carbohydrate (santalene) boiling at  $252^{\circ}C.$  or  $252.5^{\circ}C.$ ; another santalene boiling at  $261^{\circ}C.$  or  $262^{\circ}C.$ ; a carbohydrate boiling at  $130^{\circ}C.$  or  $140^{\circ}C.$ ; santalic acid an oxygenated product

to which is due the special smell of the essence and boiling at  $210^{\circ}\text{C}$  or  $220^{\circ}\text{C}$ ., (formula  $\text{C}_{15}\text{H}_{24}\text{O}_2$ ).

As santalols ought to make up 94 % of the essential oil, it is easy to detect any adulteration by determining the amount of these substances; should the santalol content sink below 90 %, the oil is no longer pure, but no fraud need be suspected if the percentage is above this figure.

The essential oil of the West Indies is prepared from certain Rutaceae (*Amyris balsamifera* and others), growing in Venezuela and tropical America. It has a far less delicate scent than sandal wood oil. *Amyris balsamifera* is the balsam of Jamaica, where it is usually known as Rose Wood; it is the Candle Wood of Guadeloupe.

Sandal-wood, when dried and pounded, is one of the ingredients of sachet-powders. The essential oil is not only used in perfumery, but also in medicine.

**55 - Clove Oil from Clove Stems (*Eugenia Cariophyllata*) in the Islands of Zanzibar and Pemba.** -- GADRE, S. T. (Industrial Chemist to Government, United Provinces, Cawnpore) in *Journal of Indian Industries and Labour*, Vol. I, Pt. 1, pp. 41-47. Calcutta, Feb 1921

It is estimated that there are in the Islands of Zanzibar and Pemba about 52 000 acres under clove (*Eugenia Cariophyllata*) cultivation, and about 4 700 000 trees in bearing; the plantations are chiefly owned by Arabs, and a few by Indians. The average output of the African cloves has been about 14 000 000 lb. a year but in 1918-19 the yield is reported as nearly 29 000 000 lb. The average yield per annum from a plantation of about 3 000 trees about 60 years old under European management is estimated to be 8 lb. per tree; 98 trees are planted to the acre.

The true cloves of commerce are the dried flower buds but the stems which primarily were known to contain a fairly large amount of brown dyestuff have since been found to contain an essential oil resembling that obtained from the true cloves. A sample obtained from a Zanzibar firm was found to yield about 3 % of this oil, and to contain about 80 % eugenol. These results indicated a possibility that the distillation of these stems might be successfully practised in India on a commercial scale, and a consignment was delivered to Cawnpore for experimentation.

The stems were soaked in water over-night and the wet, swollen stems were then distilled with steam at a good pressure. A description is given of the plant and process employed.

The freshly distilled oil had a pale yellow colour, which deepened on exposure to air and light and turned distinctly brown when heated in a water bath. In aroma and quality it was equal to the best English distilled clove oil. It had an irritating action on the mucous membrane and left a slight burning sensation on the skin. The free eugenol in the oil was estimated by the volumetric method of VARLEY and BOLSIING and the amount existing in an uncombined state in the oil was found to be 69.86 %, and the total eugenol usually from 85 to 90 % (UMNEY'S method), but up to 95 %, has been found.

Data are given for the calculation of the cost of production of the oil. The figures refer to actual costs incurred during the experiments described above. Tables are given comparing the properties of the oil made from clove stems at the Cawnpore Laboratory with those of different samples of clove oil as quoted by PARRY (*Chemistry of Essential Oils*). The former is apparently richer in eugenol and consequently higher in specific gravity than an average sample of true clove oil, and the difference between the oil obtained from the two sources should therefore be only in quantity and not in quality. True cloves are said to yield up to 20 %, compared with stems up to 6 %. If however the price of clove oil were fixed by the eugenol content, the oil obtained from stems as here described should certainly fetch a higher value than an average sample of clove oil in the market.

From the reports made by a leading and influential firm in India and from the author's own experiments, it is considered advisable to use these stems as the main source of supply of the clove oil of trade, thus leaving the true cloves to meet other needs for which they are greatly in demand. As regards the supply of clove stems, it should be possible to obtain them with proper organisation, for a comparatively cheap price and in sufficient quantities.

- 56 - **Notes on Virginian and Turkish Tobaccos: Modes of Production, Supply and Demand with Special Reference to Rhodesia and Other Provinces of South Africa.** — I. TAYLOR, H. W., The Tobacco Industry, Tobacco Growing Countries etc., in *The South African Journal of Industries*, Vol. IV, No. 5, pp. 465-472, Pretoria, June 1921. — II. IDEM, Seed Selection in Tobacco Culture, *Ibidem*, Vol. IV, No. 6, pp. 563-571, pl. 3 July 1921. — III. IDEM, The Culture of Virginian Tobacco, *Ibidem*, Vol. IV, No. 7, pp. 650-662, pl. 4 Aug. 1921. — IV. IDEM, The Curing of Tobacco, *Ibidem*, Vol. IV, No. 8, pp. 727-732, Sept. 1921. — V. IDEM, The Culture of Turkish Tobacco, *Ibidem*, Vol. IV, No. 9, pp. 794-799, pl. 1 Oct. 1921, and in *Bulletin No. 373, Department of Agriculture, Salisbury, Rhodesia*, pp. 1-10, figs. 7, Salisbury, Dec. 1920. — VI. HEMMERLÉ, J., La culture du Tabac en Rhodesia, in *Revue Agricole de l'Île de la Réunion*, Pt. 2, No. 5, pp. 172-177, Saint-Denis, May 1921.

The opening article gives a general survey of the distribution of tobacco areas throughout the world, but apart from the data relative to the production and consumption in the United States, the detailed description of areas suitable for tobacco production, including types and quality of tobacco produced, is confined to the South African Provinces. The succeeding articles relate entirely to South Africa and cover the whole field of tobacco production from the preparation of the seedbeds right through to the marketing of the cured leaf.

I. SOUTH AFRICA. — *Distributive areas.* — The total amount of commercial tobacco produced in Africa is probably not above 70 000 000 lb. at present. In the Union of S. Africa the production for 1919 was 14 183 000 lb. and in Rhodesia 1 467 612 lb. as compared with 620 171 lb., in 1918. The types of tobacco produced can be divided into four classes, *viz* Virginian (flue-cured) in Rhodesia; Turkish in the Western Provinces; Pipe Tobacco in Transvaal (Magaliesburg); and Cigar Tobacco in Natal.

Owing to the variable characteristics attached to each type of tobacco in each country, S. African tobacco should not be compared with that grown elsewhere on the basis of quality, which is a variable term. The author however here gives the principal characteristics of the several types produced in S. Africa : — The general methods of cultivation etc. are not given in this summary as they are already well known, but certain outstanding points have been selected.

I, III. VIRGINIA. — This varies so much in its natural characteristics that the leaf from each producing area is considered separately. A rainfall of 25 to 30 inches is sufficient for cultural purposes, provided it is properly distributed. In Rhodesia, the rainfall is ample and the annual distribution fairly uniform, thus rendering this area very suitable for tobacco growing (1).

*Varieties.* — Rhodesian Virginian tobacco is practically all flue cured and varies in colour from lemon-yellow to mahogany and dark brown. Only Hester, Goldfinder and South's are grown to any extent. The last variety originated under Rhodesian conditions and is especially suited to its local environment. In the Union the varieties recommended are as follows : For heavy or dark leaf : Improved Clarksville, Boyd, Genuine Pryor, Tennessee Red, Joiner, each to be grown on heavy well fertilised soil. For medium bright or light red leaf : Joiner, Yellow Pryor, Sterling, Hester, Bullion, Blue Pryor, White Burley each to be grown on sandy loam with moderate application of fertiliser or manure. For bright leaf : same varieties as for medium bright, to be grown on sandy loam or black turf soil with light applications of fertiliser or manure.

II, III. *Seedlings and seed selection.* — Notes with reference to seedlings and seed selection (II), apply equally to all types of tobacco. An E. or N. F. exposure is considered best, and windbreaks are advisable. At the Piet Retief Tobacco and Cotton Experiment Station a very effective shelter was made with maize stalks held in position by double strands of wire. Attention is drawn to the fact that a common mistake is often made in sowing too thickly. It is estimated that if properly cleaned and graded seed is used 1 oz. is sufficient for sowing 120 sq. yd. of seed bed. (1 oz. contains approximately 300 000 seeds). Cheesecloth has been found to be the most suitable covering for seed beds.

According to SCHERFFIUS (*Bull. No. 139. Kentucky Agricultural Expt. Stn.*), and TRABUT (*Bull. No. 17. Service Botanique, Gouvernement Général de l'Algérie*), only heavy and well developed seed will give good results. The fact that imported seed gives unsatisfactory results and that the yield from acclimatised seed is invariably larger and the leaf of better quality in every respect has been demonstrated conclusively by experiments conducted by the author in the Transvaal and also in Rhodesia.

The best soil for seedbeds is a deep, light, sandy loam. Black turf soil is somewhat too heavy, but the author has obtained excellent results

(1) See *R.* Oct. 1921, No. 941. (*Ed.*)

by applying sand to turf soil and thoroughly mixing together, the plants being ready for transplanting 60 days from the date of sowing.

III. *Soils and Fertilisers* (1). — In giving a full description of the soil-preparation before planting and fertilisers, it is stated that as a general rule, the best quality tobacco is produced on new lands, which contain a large amount of humus, particularly in the case of sandy soils which, if cultivated continuously, will not produce leaf of the best quality, regardless of the amount of fertilisers applied, apparently owing to the lack of humus.

As regards fertilisers, according to JURITZ (Study of the Agricultural Soils of the Cape Colony), many of the soils in the Cape Province are deficient in phosphoric oxide and similar conditions are said to exist in Transvaal (REINECKE, *Bull. No. 81. Union of South Africa, Dept. of Agriculture*) and in Rhodesia (BLACKSHAW, *Rhodesia Agricultural Journal*, Vol. VIII, No. 6). In the Union the results obtained at several Experiment Stations of the Tobacco and Cotton Division of the Department of Agriculture indicate that the following formula is well suited for most tobacco growing areas :— Nitrate of soda 160 lb., dried blood 200 lb., sulphate of potash, 200 lb., superphosphates (37 %), 320 lb. The whole is well mixed and applied to 1 acre, once in 4 years. A ratio recommended as most suitable is 2 ½ % phosphoric oxide to 1 % nitrogen and 1 ¼ % potash.

III. *Rotation of Crops* — Rye is recommended as a suitable crop for improving tobacco soils, and should be turned under just before the seed heads appear. On very light sandy soils leguminous crops can be used with advantage. It is considered that a green manure crop (2) should be grown and ploughed under once in 3 years in order to maintain the proper supply of humus in the soil.

III. *Transplanting* (3). — During October, November and December; if planted out later unsatisfactory results have been obtained. The method employed depends upon individual conditions, and where irrigation is not necessary, transplanting can be done on the level or on ridges. There is a tendency on the part of many growers to transplant before the seedlings are sufficiently large. Plants should be at least 3 inches in height and better stands are secured if allowed to remain until 4 to 5 inches high. If the tobacco is to be flue-cured, about 10 to 15 acres is transplanted at one time in order to secure sufficient leaf of uniform ripeness and even texture to fill a curing barn at each harvest.

A description follows of the cultivation, topping, suckering and ripening.

III. *Methods of harvesting*. — The whole plant method has been found the most economical for air, sun or fire curing, but for flue-curing the 'single leaf' method is generally used. For the first method the easiest way has been found to split the stalk to within about 4 in. of the ground,

(1) Experiments in Manuring See R. Nov. 1917, No. 1025. (Ed.)

(2) For green manuring, see R. April 1916, No. 387. (Ed.)

(3) For spacing of plants, see R. June 1917, No. 552. (Ed.)

bend the stalk slightly away from the operator and sever near the ground by a sloping cut. The plant is then placed astride a tobacco stick, which will carry from 6 to 10 plants, and is carted to the curing barns, etc.

In regard to the effect of the two methods of harvesting in respect to the weight of cured leaf obtained, GARNER (*Bull. No. 79. U. S. Dept. of Agriculture, Bureau of Plant Industry*) has shown conclusively that the loss of dry matter is greater when the whole plant is harvested, and the weight of the cured product is therefore less than when the tobacco is harvested by the single leaf method.

III.-VI. *Cost of Production and Profit per Acre.* — This naturally varies with labour conditions, etc., but the author found the cost of growing tobacco in the Transvaal (1916-17) was approximately 4d. per lb. with an average selling price of about 6d. per lb. In Rhodesia the cost of producing is about 9d. per lb., and the present selling price of a normal crop is about 1s 6d per lb. It is interesting to compare these figures with the existing cost and selling prices in the United States, *e. g.* the average cost in the Burley District of Kentucky is from 26 cents (1s 1d) to 30 cents (1s 3d) per lb. (*Western Tobacco Journal*, Vol. XLVII, No. 24). In the Dark Tobacco District of the same state the cost of production averaged 16 cents (8d) per lb. During 1919 Burley Tobacco sold at an average of 55.8 cents (2s 4d) per lb. (*Western Tobacco Journal*, Vol. XLVII, No. 3), and dark tobacco at an average price of 24 cents (1s) per lb. so that growers in each of these sections realised larger profits than the growers in South Africa.

I. V. TURKISH (1). — This tobacco in both the Western Province and Rhodesia has good colour, texture, body and burning qualities, but its flavour and aroma are not so pronounced as that produced in the Levant. Properly handled and matured however it would find a ready sale overseas for blending purposes.

As Turkish tobacco is sun-cured it is essential there should be practically no rainfall during the curing period. It is preferable if the rains cease about 1 month after transplanting. Generally speaking the climatic conditions in Matabeleland are more suitable than in Mashonaland where the rainfall is too heavy. In Rhodesia as a whole, the best results have been obtained on red clay loams derived from diorite or schist formations. Fertile sandy loams are also used and give good coloured tobacco with good combustibility (2) but lacking in body.

*Varieties.* — Plantings almost entirely confined to Kavalla, but in the Western Province, Soulook, Samsun, Dubek and Yaca are also grown.

II *Seedbeds, Preparation of Soil, etc.* — Similar methods to those adopted for Virginia tobacco.

*Location.* — Low lying soil is to be avoided as in these areas the crop is more liable to white rust (*Oidium tabaci*).

V. *Fertilisers and Manures.* — In Rhodesia these are unnecessary

(1) For Turkish Tobacco in Cape Province, see R. Jan. 1914, No. 32. (*Ed.*)

(2) For Investigations on Combustibility, see R. Aug. 1916, No. 868. (*Ed.*)



on red clay loams, and on sandy loams Kraal manure at the rate of 8 tons per acre or a commercial fertiliser (8-20-10 formula) is applied at the rate of 200 lb. per acre some time before the crop is transplanted.

V. *Transplanting, Cultivation.* — See *Virginian*

*Topping and Suckering.* — This type of tobacco is not topped and consequently it is not usually necessary to sucker the plants, and if the suckers appear when the plants are nearing maturity they should be removed.

*Priming.* — Small leaves at the base of the plant should be removed before the flower head appears.

V. *Harvesting and stringing.* — Single leaf method always employed.

*Wilting.* — This type of tobacco is allowed to remain in the wilting room until the leaf turns pale greenish yellow. Lack of proper supervision at this stage is annually the cause of considerable loss to growers especially in Southern Rhodesia. A description of a wilting room is given.

CURING (1). — A diagram indicates the various methods of curing employed and the types of tobacco cured by each method. The methods described include : a) air curing ; b) sun-curing ; c) fire curing and d) flue curing.

These methods do not differ from the generally recognised methods adopted. The barns used in Rhodesia in the two latter cases are also described in detail by HEMMERLÉ (VI).

Regardless of the method used in curing, tobacco can be either increased or decreased in value by the method of handling employed after the leaf is cured. The method recommended by TAYLOR is to bring the leaf into condition and place it in bulks or stacks about 6 ft in height, and a packing shed with a conditioning cellar should always be provided. Leaf which is harvested ripe but cures out with a greenish colour can be greatly increased in value by this method of handling as bulking removes the green colour and improves the aroma of the tobacco. When in proper condition for bulking or baling, the web of the leaf and lower half of the midrib, from tip to butt, should be supple, but the upper half of the midrib should be only slightly pliable.

57 — **White Burley Tobacco in Canada.** — FREEMAN, H. A., in *Dominion Department of Agriculture, Central Experimental Farm, Bulletin* No 45, pp 1-36 figs. 22, bibliogr. of 4 works. Ottawa, Feb 1921

Information concerning the origin of varieties grown in Canada (Broad-leaf White Burley, Standup White, Johnson's Resistant), seedbeds and seedlings (2), transplanting, soils and preparation of land, rotations, manuring and fertilising, cultivation, topping, suckering, diseases and pests, seed selection, harvesting, curing and curing sheds, handling after curing, stripping, marketing, etc.

(1) For Experiments in curing, drying and fermentation, see R. March 1915, No 283; R. Aug. 1915, No. 819. R. March 1916, No 202; R. Feb 1917, No. 153; R. May 1917, No. 512 and R. Jan. 1919, No. 63. (Ed.)

(2) See No. 56 of this *Review*. (Ed.)

ARBO-  
RICULTURE

58 - The "Pejibaye" (*Guilielma utilis*), Fruit with High Food Value in Costa Rica. — POPENHOE, W. (Office of Foreign Seed and Plant Introduction, United States Dept. of Agriculture) and JIMENEZ, O. in *Bulletin of the Pan-American Union*, Vol. LIII, No. 5, pp. 449-462, pl. 6. Washington, D. C., Nov. 1921.

Description of the "pejibaye" or "chontaduro" palm (*Guilielma utilis* Oerst = *Bactris utilis* Benth and Hook) which grows in Costa Rica, Panama and Northern South America. It is considered probable that the plant found in Venezuela, Colombia and Ecuador described botanically as *G. speciosa* and *B. gachipaes* is specifically identical with the Costa Rica *G. utilis*.

The authors recommend the introduction into tropical regions of this plant with a view to the extension of its culture so as to place it upon the substantial basis of a profitable commercial fruit and give details of the climate and soil to which it is adapted and the culture and varieties.

As regards the composition and food value of this fruit, the following figures show the chemical composition compared with other tropical fruits

	Water	Protein	Fat	Carbo- hydrates	Ash
	%	%	%	%	%
<i>Hymenoclea Courbaril</i> . . . . .	15.1	6.6	1.6	73.9	2.8
<i>Guilielma utilis</i> (boiled) . . . . .	48.8	2.8	0.7	40.9	0.8
Banana . . . . .	75.3	1.3	0.6	22.0	3.8
Avocado (Mexican) . . . . .	66.3	1.8	26.6	6.6	1.5
Avocado (Guatemalan) . . . . .	71.2	1.7	20.5	5.4	1.1
Avocado (West Indian). . . . .	78.6	1.6	9.8	9.0	0.8

An analysis of ripe, uncooked fruit gave the following result : Starch 26.90 % ; sugar 4 % ; fat 5.82 %.

The energy producing value, expressed in calories amounts to 1096 as compared with 1564 *H. Courbaril*, approximate average of 1000 avocado, and 459 banane. From the point of view of economic value, however, the "pejibaye" and the avocado occupy the first places, owing to the somewhat disagreeable odour and taste of the apparently highly nutritious *H. Courbaril* fruit.

The author describes the various ways in which the fruit is prepared for food. An experiment made by Doña AMPARO DE ZELEDÓN, based upon a suggestion of WERCKLE has given excellent results, viz. the paring of boiled fruits, removal of seed and oven drying for several hours. The water is extracted but the fruit retained its form, colour and general character. Six months later the dried fruit when boiled for half an hour regained the consistency and flavour of the boiled fresh "pejibaye".

In addition to the fleshy portion of the fruit, the hard white kernel which contains a large quantity of oil, is eaten ; the terminal bud can also be used as a vegetable but would necessitate the destruction of the palm and is therefore not worth consideration.

59 - **Forestry in China.** — *Republic of China, Government Bureau of Economic Information Bulletin, S. 1, No. 11. Peking-Shanghai, May 6, 1921.*

FORESTRY

China's progress in forestry during 1920 was significant. Developments in the year included: 1) the establishment of the Shantung Forestry Bureau; 2) the extension of afforestation to all the provinces; 3) the activities of the Provincial Forestry Station at Nanking; 4) the co-operation in the planting of trees by Kansu-Haichow, Peking-Hankow, and Tientsin-Pukow Railways; 5) the cultivation and distribution of plants; 6) the increased interest of district magistrates, agricultural associations, companies and individuals.

The number of plants produced during the year totalled about 130 000 000 and the cost of cultivating and planting them amounted to nearly \$250 000 (£ 1 = \$8.46). The institution of Arbor Day augured well for the future. The expansion of this practice of planting trees among all classes of the community must be included among last year's developments.

The Kiangsu Provincial Forestry Station was established in 1916. The yearly estimated expenditure was \$34 000, which was approved by the Provincial Assembly and appropriated by the Financial Commissioner of the province. The area under cultivation is 34 000 "mow" (1 mow =  $\frac{1}{6}$  acre) with 25 000 000 trees. There are also three gardens for the cultivation of shoots, occupying an area of 371 "mow", and three branch stations. Two more branch stations are under consideration. Students are trained at the Central station for a period of three years, and after this course they are sent to their districts to specialize in the industry. There are three afforestation stations and three gardens for the cultivation of plants in Shantung which occupy a total area of 2 000 "mow"; the annual expenditure appropriated by the Provincial Financial Commissioner is \$22 000.

The Government Railways which stand in need of a continuous supply of timber, are taking steps to plant trees for their own use. The Kansu-Haichow Railway has appropriated a sum of \$17 000 for forestry purposes. Three afforestation stations, each 120 "mow" in extent and the planting of 4 000 000 trees on each side of its track, are the result of its enterprise up to the present time. In the estimated expenditure of the Tientsin-Pukow Railway a sum of \$6 000 has been appropriated and trees already planted on this line number 850 000. Two gardens for the cultivation of plants have also been established. The Peking-Hankow Railway has assigned a large area for afforestation purposes in Honan.

In Central and North China there are 21 afforestation establishments occupying in all an area of 15 000 "mow" and having a total annual expenditure of \$106 000. The largest and most prosperous afforestation area is situated in the North of Kiangsu near Yenchow, where between 3 000 and 4 000 trees are grown every year. In addition specialist schools have been established in many provinces, notably in Anhwei, Chekiang, Hupeh, Szechwan, and Shansi. It has been estimated that 25 % of the

1 800 "hsiens" (departments) in China are now engaged in this work, which, it is hoped, will in due course transform many barren tracts into rich forests.

**60 - The Forests of the United States as a Source of Liquid Fuel Supply. —**

HAWLEY, R. C. (Yale University, New Haven, Conn., U. S. A.), in *The Journal of Industrial and Engineering Chemistry*, Vol. XIII, No. 11, pp. 1059-1060. New York City, Nov. 1, 1921.

The purpose of this paper is to present a concise statement showing the amount of wood available for conversion into liquid fuel which can be produced annually on the forest lands of the United States (Alaska and insular possessions excluded).

The forest area of the United States is as follows :

*Area and Growth of the Forests of the United States.*

Area forested Acres	Character	Present Growth Cub Ft	Possible Growth Cub Ft.
245,000,000	Second growth	5,995,000,000	14,700,000,000
81,000,000	Forest wasteland on which nothing can grow without reafforestation	Nil	4,860,000,000
137,000,000	Virgin forests.	Nil	8,220,000,000
<b>463,000,000</b>		<b>5,995,000,000</b>	<b>27,780,000,000</b>

To-day the annual growth of wood is approximately six billion cubic feet. The possible growth, provided the lands are properly restocked after cutting, and protected, is conservatively estimated at twenty-seven and three-quarters billion cubic feet per year. Not all of this annual growth would be available for manufacture into liquid fuel, as provision must be made for lumber and numerous other forest products.

Each year approximately twenty-six billion cubic feet of wood (far in excess of the present growth and taken principally from the accumulation of virgin timber) are removed from the forests, distributed as shown in the following table.

*Amount of Wood Removed Annually from the Forests of the United States.*

Cut	Equivalent in Standing Timber Cub Ft.
Lumber . . . . .	8,913,300,000
Fuelwood. . . . .	10,450,000,000
Other products. . . . .	4,955,000,000
Destroyed by fire, insects and fungi . . . . .	1,739,000,000
<b>Total . . .</b>	<b>26,048,915,000</b>

Out of this total cut, at least 4 800 000 000 cubic feet of the lumber are lost through waste in the woods and at the mills. Adding to this the 1 730 000 000 cubic feet destroyed by fire, insects, and fungi gives a total of 6 530 000 000 cubic feet of wood annually wasted which should be available for liquid fuel, without encroaching upon the supply needed for other purposes. Furthermore, the possible annual growth (27 750 000 000 cubic feet) exceeds the annual requirements (26 000 000 000 cubic feet) by 1 750 000 000 cubic feet, furnishing an additional 1 750 000 000 cubic feet, for liquid fuel. Finally, the increased growth which will follow intensive forest crop management, particularly the removal of small wood in thinnings, should amount to not less than 10 per cent of the possible growth, or 2 750 000 000 cubic feet. This gives a total of 11 000 000 000 cubic feet, as summarized below.

*Estimate of Amount of Wood for Liquid Fuel which could be secured from Forests of the United States without Encroachment upon Supply of other Forest Products.*

	Cubic feet
Waste in the wood and at the mills . . .	4,800,000,000
Losses from fire, insects & fungi . . . (taken out in thinnings)	1,730,000,000
Excess of possible growth over annual cut (taken out in thinnings)	1,750,000,000
Increased growth due to more intensive crop management . . . (taken out in thinnings)	2,750,000,000
<i>Total . . .</i>	<b>11,030,000,000</b>

In making a calculation of how much liquid fuel this 11 billion cubic feet of wood will produce, a cubic foot of wood is taken as weighing 30 lb and a ton of wood as yielding 15 gallons of alcohol. On this basis the 11 000 000 000 cubic feet of wood will furnish an annual output of 2 475 000 000 gallons of alcohol or 33 per cent. the total amount of alcohol needed to replace the present output of gasoline.

The cost of the raw wood laid down at the manufacturing plant is estimated to average 25 cents per gallon of alcohol produced by present methods, although where the proper region and species are chosen this figure may be reduced to 7 cents a gallon. It remains for the chemists to develop improved methods for utilizing the cellulose more completely, thereby increasing the output of liquid fuel secured from a ton of wood.

Professional foresters may be expected to co-operate fully with the chemists in their efforts to utilize wood as liquid fuel for at least two reasons: firstly, because utilization of waste in the woods and at the mills clears the forest of material now unsaleable which is often a dangerous fire and insect risk, and secondly, because the opportunity to dispose of small trees in thinnings will make more intensive forestry possible, and this in turn will increase the quality and quantity of forest crop production.

It is realized that the utilisation of wood as liquid fuel on a large scale is not likely to come for a decade or more. In order to have available when needed the largest possible annual supplies of wood, forested areas must without delay be protected, scientifically cut, and completely restocked. For this reason the Author asks for the support of the American Chemical Society in providing for the more satisfactory control of the nation's forest resources.

### LIVE STOCK AND BREEDING.

#### HYGIENE

61 - International Conference for Defence against Epizootic Disease, Paris, May-June 1921. — MASSE, A., in *Comptes rendus des séances de l'Académie d'Agriculture de France* (Meeting of June 1, 1921), Vol. VII, No. 21, pp. 481-487. Paris, June 1921.

At this International Conference all the States of Europe were represented as well as a large number of the States of North and South America, Asia and Australia.

The conclusions arrived at may be summarised under 3 heads:

1) As regards rinderpest, it was decided that as soon as this disease makes its appearance in the territory of any State, it is the duty of the neighbouring States to close their frontiers not only to cattle, but at the same time to other species of animals which not being susceptible to the disease, are not generally regarded as likely to spread it.

Owing to differences of opinion regarding the pig as a carrier of disease germs, the Conference was of opinion, that the scientists of the different countries should be requested to direct their investigations to the danger of infection caused by the transport of certain animals, and even of some animal products, including frozen meat. The Delegate of Poland drew the attention of the Conference to the fact that to require the destruction of all animals suffering from rinderpest (a disease very generally prevalent to a greater or less degree) would entail the complete destruction of stock, and the Conference in the light of this objection limited itself to passing a resolution recommending the various Governments to enforce the destruction of animals attacked by rinderpest.

It was next laid down that the first duty of infected countries towards their neighbours was to warn the latter immediately of the presence of serious diseases and to keep the neighbouring states informed of the minutest details connected with the course of the malady.

2) The second question dealt with the measures that should be taken by the States to guarantee that all stock imported into other countries is perfectly healthy and free from any suspicion of infection. The Conference decided, that a period of quarantine before shipping would best serve the purpose. It also considered it highly desirable that the States should agree upon an identical form of certificate, giving guarantees of equal value from whatever country the stock was imported.

3) Thirdly the conference decided to establish a permanent bureau at Paris for the purpose of studying the measures to be adopted against epizootic disease, and of publishing an international Bulletin containing

precise information respecting the sanitary condition of each country as regards rinderpest, foot-and-mouth disease, contagious peripneumonia, anthrax, sheep-scab, rabies, glanders, dourine and swine-fever, as well as reports of the researches carried on in the different laboratories.

- 62 - **Mexican Whorled Milkweed (*Asclepias Mexicana*), a Plant Poisonous to Live Stock in the United States.** — MARSH, C.D., and CLAWSON, A. B., in *U. S. Department of Agriculture, Bulletin* 969, 16 p., Tables 7, Plates 2. Washington, October 1921.

*Asclepias mexicana*, which grows in California and Nevada, has long been considered a stock-poisoning plant particularly dangerous to sheep, but nothing was definitely known as to the symptoms produced by it, or its toxic dosage.

The experiments made on sheep by the Authors have shown, that it produces effects similar to those caused by the other Whorled Milkweeds viz., *A. galioides* (1), *A. pumila* and *A. verticillata* var. *Geyeri*.

*A. mexicana* is about equal in toxicity to *A. pumila* and about  $\frac{1}{4}$  as toxic as *A. galioides*. The lethal dose is 6 times that of *A. galioides*, but about  $\frac{1}{2}$  that of *A. pumila*.

- 63 - **Contribution to the Study of the Tuberculosis of Domestic Animals in Reference to Human Tuberculosis** (2). — GRILLI, V (Veterinario, Campobasso), in *La Clinica veterinaria*, Vol XLIV, No 18, pp 518-523 Milan, September 30, 1921.

The author bases his remarks upon his personal observations which cause him to consider that cattle, swine and poultry can become infected with tuberculosis by the ingestion of food containing the bacilli of human tuberculosis.

These facts taken in conjunction with data collected by numerous practitioners and experimentalists, amongst whom is Dr. Carlo SARTI of the Institute of Hygiene of the Royal University of Modena (who succeeded in communicating both the human and bovine form of the disease to a dog by mouth, peritoneal and blood infection), would seem to prove that KOCH's bacillus, whether taken from man or cattle, is capable of infecting other animals. This micro-organism which is resistant to acids, immobile and essentially parasitic, is the commonest bacillus found among living beings and the one which owing to its latency makes the most victims throughout the animal world, for it spares no class and attacks equally mammals, birds, reptiles, amphibians and fish.

It thus follows that the morphological, cultural and other differences observed in the bacillus according to the species of its host, only denote the transitory forms that the micro-organism is able to assume. According to BEHRING, the bacillus would seem to adapt itself to the medium in which it lives, thus acquiring a greater or less degree of virulence according to the organism from which it is derived and the organism it infects.

Even in very different races of men or cattle, the bacillus can acquire

(1) See *R.* Jan. 1921, No 68. (Ed.)

(2) See *R.* Oct. 1921, No. 973. (Nd.)

uch powers of infection, that it can be used in preparing vaccines such as FRIEDMANN's for prophylaxis against human tuberculosis, or KLIMMER'S (MIESSNER'S), which is recommended by the Dresden Institute of Veterinary Hygiene as a prophylactic against bovine tuberculosis and is prepared from tuberculous material obtained from cold-blooded animals.

- 64 - **Detailed List of Horse Strongyles in the Punjab, India.** — BOULENGER, C. I., (Pathological Laboratory, Punjab Veterinary College, Lahore), in *Parasitology*, Vol XIII, No. 4, pp. 315-326, figs. 5, bibliography of 30 works. London, November 1921.

The author gives the anatomical characters and geographical distribution of the following intestinal worms: *Strongylus equinus* — *S. edentatus* — *S. vulgaris* — *Oesophagodontus robustus* — *Triodontophorus minor* — *T. intermedius* — *T. brevicauda* — *Poteriostomum imparidentatum* — *Cylicostomum coronatum* — *C. labiatum* — *C. porulatum* — *C. longibursatum* — *C. minutum* — *C. calicatum* — *C. goldi* — *C. catinatum* — *C. pseudocatinatum* — *C. pateratum* — *C. nassatum* — *C. insigne*.

- 65 - **Resistance of Various Breeds of Donkey to Skin Disease. Observations made in Tunis.** — See No. 81 of this Review.

- 66 - **The Piroplasmosis of Indo-China.** — SCHEIN, M. H., in *Bulletin Agricole de l'Institut Scientifique de Saigon*, Year III, No. 9, pp. 269-282, 1 plate. Saigon, September 1921.

The author first gives a general description of the symptoms, evolution and etiology of these affections, and then studies the various parasitic forms met with in Indochina, mentioning the different characters distinguishing them.

I. — **BOVINE PIROPLASMOSIS.** — A) *Piroplasmoses of the bigeminum type.* — It has not yet been possible to determine the species to which the Indo-China type belongs, but it is most probable that it should be relegated to *Piroplasma bigeminum* properly so-called, and not to either *P. divergens*, or *P. argentinum*. The author has not found such severe cases of infection in Indo-China as in other countries, where he has seen 1 out of 3 red blood corpuscles attacked. In Indo-China, even in the most serious cases only 1 in 50 of these corpuscles is infested by the parasite.

In this type of bovine *bigeminum*, the nuclear apparatus appears relatively large as compared to the mass of the haematozoon. The red corpuscles even when invaded by the parasite, show no apparent signs of alteration.

The presence of this form of *bigeminum* was observed by the author first at Nhattrang, in the calves used to supply the virus for the repeated transmission of rinderpest; other forms belonging to the type Gonderia occurred at the same time. The development of rinderpest revealed the two latent infections; it was extremely difficult to say whether the two types discovered represented two distinct species, or merely two forms in the life-cycle of a single species, all the more so seeing that many of the parasites appeared in intermediate forms which might be transition forms.

Although much smaller forms than *G. mutans* were found in all the animals, the presence of the *bigeminum* type was only discovered in about  $\frac{1}{3}$  of the calves.



Of recent years, *P. bigeminum* has only appeared at Nhatrang very exceptionally, in less than 0.5 % of the cases, whereas the small form is as common as in the past.

It seems therefore, that it is necessary to acknowledge the existence in Indo-China of the two different species.

The disease caused by the *bigeminum* type corresponds entirely with the general description given. This haematozoon can kill the adult animals in which it has developed, unless they have been rendered resistant in their youth by an attack of the same parasite.

B) *Gonderia* (or *Theileria*) *mutans* Type. — It may be said, from the information received, that nearly all the animals of the Nhatrang district are carriers of this parasite. On the other hand, no one has yet reported its presence elsewhere in Indo-China though it must certainly exist there, especially in places in the neighbourhood of forests.

Four forms of this parasite have been described. In the great majority of cases, only one parasite is found in each infected corpuscle, not infrequently 2 are met with, and certain animal carriers have more corpuscles containing 2 haematozoa than others. The author has sometimes found a larger proportion of corpuscles than in the case of the *bigeminum* type: one parasitised for 8 healthy. The infected corpuscles do not appear to be altered in any way.

The parasite does not seem to be pathogenetic and it occurs, although in small numbers, in animals giving every sign of perfect health.

Since, however, the development of diseases of different kinds (rinderpest, barbone), inanition, repeated haemorrhages all cause a rapid and sometimes considerable increase in the number of the haematozoa (which shows that the organism is certainly obliged to fight against them), an equilibrium is only attained when the host is able to make full use of all the means at its disposal.

*G. mutans* may therefore have something to do with the complications that arise.

Certain authors affirm that this form never causes haemoglobinuria; SCHEIN however has observed this affection in many individuals, but always in cases where the haematozoon had been aroused by the outbreak of rinderpest.

He has several times seen (always associated with *G. mutans*), parasites belonging to the remarkable group of *anaplasms*. The infection is light, only 2 to 5 of the parasites being found per 1000 corpuscles. The presence of this form has never been known to occasion any special disturbance.

II. — BUFFALO PIROPLASMOSIS. — A) *Bigeminum* type. — A parasite of this kind was discovered in a buffalo that had been used in rinderpest experiments and been cured of that disease. Very few of the haematozoa were found in the blood when it was examined. The blood had been injected without any result into another buffalo, a calf and a kid, in which *P. bigeminum* had not been discovered. According to the Author, however negative results do not prove anything, but as this form

differs morphologically from *P. bigeminum* it is most probable that we have here to do with a distinct species. The author proposes to call this parasite *Piroplasma bubali*, until more precise data are obtained.

B) *Theileria mutans* type (?) = *Nuttalia bubali* (?). — In 1908, the author reported, in the *Annales de l'Institut Pasteur*, a bacilliform piroplasm as being present in the buffaloes of Indochina, and since that date, this parasite has frequently been found in the young buffaloes of that country. The most common form of this haematozoon is ovoid. The bacillus form is shorter and thicker than the parasite found in ordinary cattle, and the nuclear mass does not show the characteristic transverse division into two portions. This leads the author to believe, that it is a distinct species, especially since the different endoglobular parasites appear to be strictly specialised as regards their host. Further, after the blood has coagulated, the bubalin serum is much lighter and less coloured than cattle serum, greatly resembling that of the horse. Thus the blood medium seems to be very different in the case of the two hosts.

The probable systematic position to be assigned to the small piroplasmic forms of the buffalo is considered in the study of horse nuttaliasis, for they seem nearly related to the parasite producing this disease.

III. — OVINE PIROPLASMOSIS. — The small number of forms that have been studied prevents the parasite of this disease being classified with any certainty, but it is not a piroplasm properly so-called and its pathogenetic power has not yet been determined. Indeed some of the forms examined give the impression of being nearly related to *Nicolliia quadrigemina* from their resemblance to the figures given by Prof. NUTTAL. No conclusion can however be arrived at owing to lack of data.

IV. — HORSE PIROPLASMOSIS. — *Nuttalia equi*. — In 1910, the Author reported the existence in Nhatrang of a horse piroplasmosis due, according to Prof. NUTTAL'S determination, to *Nuttalia equi*. This parasite had never been found in such large numbers. It occurred in nearly every form, oval, annular, tear-shaped etc., but never in true bacillus shape, although some fusiform or shuttle-like forms presented a certain resemblance to bacilliform parasites, but, contrary to what occurred in the case of *Gonderia* (*Theileria*) *mutans*, they are not functionally differentiated micro-organisms (gametocytes). The nuclear mass is never clearly separated into the two consecutive masses that had been pointed out by M. SERGENT, and noticed by the author in the bovine bacillary form in Indo-China.

For the same reason, the small form found in the buffalo, which never assumes this aspect, appears to be nearer akin to the *Nuttalia* of the horse, than to the bovine species of *Gonderia* (*Theileria*). If this view is correct, and the classification adopted by M. SERGENT is adopted, this parasite should be called *Nuttalia bubali*.

V. — DOG PIROPLASMOSIS. — The parasite inducing this disease, like the buffalo piroplasm, and for the same reasons, would appear to belong to the genus *Nuttalia*.

Although ticks are certainly responsible for the great majority of the forms of piroplasmosis, the Author has not been able definitely to prove

their complicity. As however the buffalo of Indo-China does not readily allow itself to be examined by a European, the presence of ticks may easily have escaped notice. Further the study of the ticks of Indo-China has scarcely been begun.

67 - **Diseases of Live Stock in Fiji.** — See No. 82 of this *Review*.

68 - **Piroplasmosis due to *Theileria parva* in North Africa.** — PRICOLA, A. (Direzione Veterinaria di Tripolitania), in *La Clinica Veterinaria*, Vol. XLIV, No. 18, pp. 503-512. Milan, September 30, 1921.

The blood of animals infected by a disease prevalent in certain parts of North Africa is found to contain *Theileria parva*, and at the same time KOCH's corpuscles, which are supposed to be characteristic of the South African Coast-fever, are present in the spleen and lymphatic glands. The occurrence of these corpuscles has already been recorded by the author as a guide to diagnosis.

CARPANO described at the same time the life cycle of the parasite in the spleen and lymphatic glands. The description of the clinical form (with lesions of the abomasum) given by VELU in connection with the disease which exists in Morocco, agrees with that of CARPANO and the author. These observations do not prove the presence of Coast-fever in Libya, and no fact hitherto reported in any way demonstrated its existence in the country. The three epizootic diseases observed by the author in Tripoli and the disease which CARPANO describes at Bengasi, may be regarded as having been imported from the neighbouring French Colonies of North Africa. They might be termed "epizootic diseases of cattle grazing-grounds", to signify that they are not necessarily connected with the localities where they develop, but are imported with the cattle.

Coast-fever under the climatic conditions of the Maritime region of Libya has so far been a summer disease only.

It is unlikely that *Hyalomma aegyptium* is the agent of the transmission of coast fever which is probably due to some species of *Rhipicephalus* and amongst others to *R. sanguineus*.

The name "Mediterranean Coast-fever" cannot at present be justified. Until the contrary has been proved, it may be assumed that this disease does not exist in Sicily, Sardinia or South Italy. It has been stated, that the cattle of Southern Italy are immune to this fever, but the author reports that those of Sardinia and Sicily, as well as the animals of the podolic breed commonly kept in South Italy have been known to contract the disease. No cure exists but the author obtained excellent results with the following prophylactic methods:

a) The slaughter of all sick and infected animals. The flesh of cattle killed at the beginning of the disease has all the characters of sound meat. As was to be expected, it was used for human consumption without the slightest ill effects.

b) Destruction of the ixodes; 1) on the bodies of living animals by the use of the following mixture: 250 gm. of green soap dissolved by the action of heat in 2 litres of water to which are added by degrees, stirring

carefully all the time, 8 litres of crude paraffin (the short duration of the outbreaks renders it unnecessary to make tanks, or use arsenical baths ; 2) on the ground, by burning ; red hot sheets of zinc covered with hot embers are passed slowly over the ground.

As these cattle are butchers' beasts, losses can be reduced to a minimum as the meat is always fit for use.

- 69 - **Note on the Trypanosomiasis of the Dromedary (Debab)** (1). — SERGENT, P. and DONATIEN, A., in *Archives des Instituts Pasteur de l'Afrique du Nord*, Vol. I, Part 2, pp. 179-184. Tunis, July 1921.

As a result of their researches on the course of dromedary trypanosomiasis, the authors state that it much resembles human malaria, the best known of haematozootic diseases.

The acute stage in which death may supervene during a prolonged access of fever, is followed by a chronic stage ending in recovery or cachexy. This chronic stage is marked by sudden relapses, only lasting from 1 to 2 or 3 days, with intervening periods of calm during which the disease is latent, there is no fever and the peripheral blood is free from parasites. These conditions may continue from a fortnight to several months. These long latent periods preserve the virus of one season in a condition suitable for conveyance the following year by insect carriers. Hence the difficulty of adopting any prophylactic measures against these diseases, in which the vertebrate is the reservoir of the virus.

- 70 - **Critical Study of Some of the Nematodes of Camels in India.** — BOULENGER, C. L. (Pathological Laboratory, Punjab Veterinary College, Lahore), in *Parasitology*, Vol. XIII, No. 4, pp. 311-314, figs. 3, bibliography of 6 works. London, November 1921.

The author gives the anatomical characters and geographical distribution of the following species of nematodes found in the Indian camel: *Haemonchus longistipes* and *Nematodirus mauritanicus* Maupas and Seurat 1912.

- 71 - **The Animal Parasites of Foxes with special Reference to some Species of Hookworms (*Uncinaria*)** (2). — I. RILEY, W. A. (Chief of the Division of Entomology and Economic Zoology, Department of Agriculture, University of Minnesota, Minneapolis), An Annotated List of the Animal Parasites of Foxes, in *Parasitology*, Vol. XIII, No. 1, pp. 86-96, Bibliography of 34 works. London, March 1921. — II. RILEY, W. A. and FITCH, C. P. (University of Minnesota, St. Paul), The Animal Parasites of Foxes with special reference to Hookworms, in *Journal of the American Veterinary Medical Association*, Vol. LIX, New Series, Vol. 12, No. 3, pp. 294-305, bibliography of 8 works. Washington, June 1921.

The industry of breeding foxes, especially silver foxes, for the sake of their fur (3) has increased enormously of late years, but the breeder has paid but little attention to the few parasitic diseases attacking these

(1) See: R. Dec. 1918, No. 1368; R. Nov.-Dec. 1920, No. 1139; R. Nov. 1921, No. 1133. (Ed.)

(2) See R. July 1921, No. 736. (Ed.)

(3) See R. August 1921, No. 846. (Ed.)

animals, which in their natural condition appear to suffer little in this respect.

Now however when any factor affecting the health of the foxes or the condition of their coats, is of great economic interest, a careful study of the parasites infesting these animals is of considerable importance.

With the object of contributing to the knowledge of the parasitic affections of the fox, the author gives a detailed list, together with notes on the synonymy, anatomical characters, life-history and pathogenetic importance of the following animal parasites belonging to 9 orders, and to the following respective number of species: Protozoa 4 — Cestodes 16 — Trematodes 10 — Nematodes 20 — Linguatules 1 — Mites 3 — Ixodes 12 — Mallophaga 2 — Siphonaptera 6.

II. — The examination of certain specimens of faeces from three fox-farms showed that the severe losses among these animals, when kept under insanitary conditions, were chiefly due to parasites belonging to the genus *Uncinaria*.

A considerable number of hook worms have been reported for the fox. The authors mention the 3 most important species: *Ancylostoma caninum*, *Uncinaria criniformis* and *Uncinaria polaris*. and give a detailed description of their anatomical characters and life-history.

SYMPTOMATOLOGY. — The common symptoms of hookworm infestation are emaciation, poor coat and general cachexia. These conditions are however produced by causes other than hookworms, and the only sure method of making a positive diagnosis is an examination of the faeces.

PROPHYLAXIS. — It is most important that animals found infested with hookworms, ascarids or coccidia should not be accepted by the breeder before being subjected to thorough medical treatment at the seller's risk. Where this is not feasible, the animals should be isolated for a few days after purchase, carefully examined and treated if necessary.

In the construction of yards, great attention ought to be paid to drainage to avoid the passing of infection from pen to pen. For various reasons it is preferable to have the pens separated by a distance of 1 ½ ft. to 2 ft., to allow for drainage.

Advice is given as to the hygienic measures to be adopted for the floors of the pens, so that the soil may be easily disinfected. For this purpose the authors suggest spraying with burning oil.

TREATMENT. — The authors give the treatments recommended by HANSEN, HALL, DARLING and SMILLIE (1). The most practical method would seem to be the following: a capsule of oil of chenopodium, containing 1 to 3 minims according to the strength of the animal, is given about one or two hours after a small meal hidden in a piece of meat; 4 hours after the dose of oil, a large ration of liver, which acts excellently as a cathartic, should be fed to the patient, and the treatment repeated after 10 days.

(1) See R. December 1921, No. 1234. (Ed.)

- 72 - **Cystoid Forms of *Taenia serialis* in the Psoatic and Dorsal Muscles of Wild Rabbits and Hares in Sardinia.** — GALBUSERA, S., in *Giornale di Medicina veterinaria*, Vol. LXX, No. 41, pp. 657-660. Turin, October 29, 1921.

The author gives a brief summary of the discussions respecting the life-cycle and parasitism of *Taenia serialis* which differs from *Taenia coenurus* (*Coenurus cerebralis*), in the fact that its cystoid form is of somewhat rare occurrence, whereas this stage of *T. coenurus* is well known to all veterinary surgeons and meat-inspectors. The author states that the cystoid form of *T. serialis* is frequently found in the wild rabbits and hares of Sardinia. COBBOLD and CAGNY have also met with it in the squirrel, and STILES has found it in the horse, in the United States.

Although all other observers say that the usual habitat of this cystoid form are the large serous cavities and the subcutaneous connective tissue, the author has seen it only in the interior of masses of muscle, especially in the psoatic and dorsal muscles.

#### ANATOMY AND PHYSIOLOGY

- 73 - **Researches on the Rate of Growth of the Dairy Cow. Extra-Uterine Increase in Weight.** — BRODY, S. and RAGSDALE, A. C. (Department of Dairy Husbandry, University of Missouri Agricultural Experiment Station, Columbia), in *The Journal of General Physiology*, Vol. III, No. 5, pp. 623-633, Tables 5, bibliography of 14 works. Baltimore, May 1921.

The growth period of Jersey and Holstein cows is made up of at least 3 cycles; two extra-uterine cycles, with maxima at about 5 and 20 months after birth, and one intra-uterine cycle, the maximum of which has not yet been determined. The equation of an autocatalytic monomolecular reaction was found to give very good results when applied to the cycle having its maximum at about the 5th month. The values obtained from this equation in the case of the cycle reaching its maximum at about the 20th month were higher than the observed values, probably owing to the retarding effects of pregnancy and lactation.

- 74 - **Lactic Secretion in an Unmated Mule** (1). — GIROTTI, N. (Veterinario, Padua), in *La Clinica Veterinaria*, Vol. XLIV, No. 18, pp. 523-526. Milan, September 30, 1921.

The author describes a case (noticed by himself and verified by one of his colleagues), of a strong, healthy unmated mule 9 years of age, yielding a daily average of 3 to 4 litres of milk of normal quality from April-October 1920. The lactic secretion was again produced, without any stimulation and with symptoms of "heat," as soon as green feeding was resumed in the spring of 1921. It was however less abundant, being 1 litre a day if the animal was milked daily, and much less if some days were allowed to elapse without milking. The mule was always in excellent health.

As the lactic secretion continued all the time of the regular periods of "heat" it may be supposed that it was at all events largely due to a hormone produced by the ovule and ovary.

(1) See *R. Jan.* 1920, No. 98. (*Ed.*)

75 - **Experiments made in Egypt on the Digestibility of Bersim (*Trifolium alexandrinum*)** (1). — PRESCOTT, J. A., in *Bulletin No. 5, Sultanic Agricultural Society, Technical Section*, pp. 1-10, Tables II. Cairo, April 1920.

FEEDS AND  
FEEDING

Report of experiments covering a period of 5 days conducted in 1916-17 with sheep (of Leicester origin and local breeds), fed four times daily with fresh bersim. Determinations of the digestibility of two varieties of bersim were made ("Fahl" and "Misqawi"). The results obtained are shown in the following Table.

*Digestibility of each Constituent digested, vars. Fahl and Misqawi.*

	Total organic matter	Total nitrogenous matter	Albumi- noids	Ether extract	Woody fibre	Carbo- hydrates
<i>Fahl</i>						
January 2 . . . . .	68.1 %	74.8 %	73.1 %	59.0 %	45.6 %	76.9 %
February 2. . . . .	63.7	67.6	61.9	55.2	47.0	71.3
<i>Misqawi</i>						
Average of 7 determi- nation from 1 cut- tings. . . . .	69.1	73.0	69.2	49.9	60.5	74.0

The digestibility of these two varieties is therefore approximately the same, except that the fibre of Fahl appears to be less digestible than that of "Misqawi."

In estimating the feeding value of green bersim, the water content in the different cuttings should be considered.

The dry matter in "Misqawi" from January to March is about 15 %. The digestible constituents per ton of green bersim containing 15 % dry matter are as follows:—

Organic matter 91.0 kg.; — albuminoids, 15.5 kg.; amides, 3.2 kg.; fats, 2.9 kg.; fibre 20.1 kg.; carbohydrates 49.2 kg.

For the months of April and May, the feeding value per ton is considerably higher owing to the increase in dry matter. If however the water content has been determined, it is a simple matter to calculate the feeding value of any bersim.

An appended note gives data relative to the mineral matter content of bersim.

76 - **Brazil Beans, or "Mulatinos", a Variety of *Phaseolus vulgaris*, as a Stock Feed. Researches and Experiments Made in Germany.** — GOY (Communicated by the Königsberg Agricultural Station), in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XXXII, Part 46, pp 661-662 Berlin, November 1921.

The nutritive value of Brazil Beans ("Mulatinos"), like that of other stock feeds recently introduced into Germany, has not yet been determined

(1) See R. May 1917, No 402 (*Ed.*)

by practical experience, although large quantities have found their way on to the market.

As in numerous cases the results of feeding these beans to stock had been reported to be unsatisfactory, the author thought it desirable to study more closely the food value of this variety of *Phaseolus vulgaris*.

The analysis of the beans (which are usually small, flat and of the colour of cocoa) gave the following results : Crude protein 21.26 % — Digestible protein 19.38 % — Fats 1.86 % — Crude fibre 3.23 % — Nitrogen free extracts 54.92 % — Ash 4.16 % — Water 10.89 % — Sand 0.12 % — Acidity 0.49 %. The protein and fat contents agree very closely with the corresponding averages determined for the horse-bean, and the nutritive value of the two may be regarded as equivalent.

At the Königsberg Agricultural Station, experiments have been made in feeding horses, cows and pigs with raw and cooked Brazil beans, with or without the water in which they were boiled. The following observations were made as to the effect on the different species of animals :

**HORSES.** — Horses utterly refused to touch the beans, and would not even eat them after fasting for several days.

**PIGS.** — Pigs were with difficulty persuaded to eat the beans raw, and took them unwillingly even when cooked.

An exclusive ration of 2 ½ kg. of beans fed to young adult pigs had no bad effect upon the health of the animals. The addition of a little salt, or other aromatic substances appears to render the beans more appetising, but they could never be used for fattening, as the pigs will not eat them readily.

**Cows.** — Cows ate the beans without any difficulty, whether fed crushed and raw or boiled. No diarrhoea or other bad effects were noticed. Since however there have been cases of severe diarrhoea among bulls and swine that have eaten large quantities of raw beans, it is better to give cows boiled beans, and perhaps to drain off the cooking water.

This new article of diet has not been found to affect milk production, the quality of the milk or the taste and quality of the meat.

77 - **The Concentrated Food "Fruges Lin", or "Nutritivo Squassi", in Feeding Cattle (1); Experiments Made in Italy.** — BRENTANA, D, in *Rivista di Agricoltura*, Year XXVI, No. 43, pp 618-621; No. 44, pp. 632-636, Parma, October 28, and November 4, 1921.

The concentrated food known on the market under the names "fruges lin," or "nutritivo Squassi" consists of a mixture, in constant proportions, of linseed-cake meal, molasses, tomato residue and uncrushed grape pips. According to the analysis made at the "Laboratorio di Chimica agraria della R. Scuola Superiore di Agricoltura" of Milan, its percentage composi-

(1) Successful experiments have been carried out with this food, as compared with bran, at the Agricultural Experiment Station of San Michele (Province of Trento). It was judged to be very suitable for draught and fat cattle.

See *R.* April 1921, No. 405. (*Id.*)



tion is as follows : Water 9.5 — Crude protein 15.0 — Crude fat 8.8 — Crude fibre 23.7 — Ash 5.8 — Nitrogen-free extract 37.2 — Digestible protein 10.62.

In the feeding experiments which lasted 30 days, the author used 19 cattle of the Brown Alpine breed ; he adopted the method of equivalent groups, and all his experiments were preceded by a period of observation to determine the effects of the ordinary ration, and by a period of transition.

The results are given in the following Tables, Groups B, F, H, serving as controls. The composition of the various groups was as follows : A, 2 young oxen 26-28 months old — B, *idem* — C, 1 young bull and 2 heifers of 12 to 13  $\frac{1}{2}$  months. — D, *idem*, F, *idem*, F. G. H. each consisted of 2 young calves (one a bull and the other a heifer), from 3 to 4 months old.

TABLE I. — *Rations Fed (in kg.)*

Lots	Composition of ration			Ration Content in .				
	Hay	Outs	" Fruges lin "	Dry matter	Digestible protein	Digestible fat	Nitrogen- free extract digestible fibre kg.	Starch value kg.
A	9	—	1.5	9.36	0.58	0.20	4.40	3.53
B	11	—	—	9.70	0.52	0.13	4.80	3.56
C	5	—	1.5	5.76	0.40	0.15	2.67	2.27
D	6	—	0.75	5.98	0.36	0.123	2.85	2.27
E	7	—	—	6.20	0.33	0.085	3.20	2.26
F	3	—	1	3.55	0.24	0.10	1.62	1.40
G	2.5	0.250	1	3.32	0.24	0.10	1.52	1.38
H	3	0.700	—	3.27	0.21	0.07	1.61	1.38

TABLE II. — *Increase in Live-Weight obtained (in kg.).*

Lots	Initial live-weight per lot	Final live-weight per lot	Increase of live-weight per lot in 30 days	Daily average increase in live-weight per head
	kg.	kg.	kg.	kg.
A, 2 head	949	987	38	0.635
B, 2 "	972	1002	30	0.500
C, 3 "	747	801	54	0.600
D, 3 "	672	726	54	0.600
E, 3 "	659	705	46	0.512
F, 2 "	212	249	37	0.618
G, 2 " (1)	189	—	—	—
H, 2 "	212	246	34	0.565

(1) One calf fell ill during the experiment, through causes independent of the feeding.

During the preliminary observation period, the author found that with a ration of 2.5 kg. hay + 0.7 kg. oats per head and per day, the average daily increase in live-weight of the calves (both males and females), was 385 gm. per head. The 4 young oxen given 11 kg. of hay per head per day, increased 465 gm. in live-weight daily, and the young bulls and heifers fed 6 kg. per head, per day, gained on an average 540 gm. These data prove once again the advantages of giving concentrated foods to calves.

The "fruges lin" was slightly moistened and put into small wooden troughs. All the animals ate it quickly and with avidity especially the young oxen.

According to the Parma market prices, at the time of the experiment, viz., 53 lire per quintal for May hay, 120 lire for oats and 80 lire for "fruges lin," the nutritive unit of the three foods would cost respectively : 2 lire — 1.90 lire — 1.87 lire.

In other experiments, the "fruges lin" fed as a supplementary ration to cows during the lactation period and at the rate of 2 kg. per head and per day, was readily eaten, produced no disturbances of the system and had a favourable effect upon the milk yield.

78 - **Microscopic Examination of Flour from the Common Reed.** — GREVILLIUS, A. V. (Landw. Versuchstation Kempen), in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XCII, Parts 5-6, pp. 195-208, figs. 23. Berlin, 1919.

Of recent years, the flour of the common reed (*Phragmites communis*), has been largely used in Germany as a cattle food ; it is obtained by drying and pounding the young plants cut before they flower. It is useful to be able to distinguish this meal and to assist in its identification ; the author gives a detailed description of the tissues composing the stem and leaves.

#### BREEDING CATTLE

79 - **A Mendelian Experiment in Crossing Aberdeen-Angus and West Highland Cattle: Experiments Made in Great Britain.** — WATSON, J. A., in *Journal of Genetics*, Vol. XI, No. 1, pp. 59-67, 1 plate separate from the text, bibliography of 14 works. Cambridge, April 1921.

These experiments were carried out with the object of determining in crosses between Aberdeen-Angus and West Highland cattle, the mode of inheritance of the horned and polled conditions and of colour differences.

The Aberdeen-Angus (polled) is black, with the exception that a small amount of white is permissible behind the umbilicus and on the end of the tail ; it has a smooth coat, short legs, and is stocky, wide, heavily-fleshed and small-boned.

Red calves are occasionally born. "Scurs," small, firm or loose, horny excrescences were once comparatively common, but have now been almost eliminated by selection. The West Highland cattle on the contrary have large spreading horns and a long and shaggy coat ; they are narrower in build and less heavily fleshed than the Aberdeen-Angus. They are also later in reaching maturity. Their colours are many, but only red and dun coloured animals were used in these experiments.

It was found in these crosses that the horned and polled conditions form a simple pair of Mendelian characters. The latter is completely dominant in the female, while in the heterozygous male, horn development is inhibited but not always suppressed.

These results are in accordance with those obtained by GOWAN (1) in first hybrids of crosses between the Aberdeen-Angus and various horned breeds. The distribution of horns in the  $F_2$  generation was as follows, in the present experiment.

	Polled	Hard "scurs"	Normal horns
Females. . . . .	15	—	3
Males (castrated) . . . . .	2	1	4
<i>Totals</i> . . . . .	17	1	7

Including the male with "scurs" as polled, we obtain the numbers 18 polled, 7 horned, which agrees very closely with the simple Mendelian ratio of 3 D : 1 R.

As regards colour, the experiments showed that black is dominant to red, and the colours behave as a simple Mendelian pair.

WILSON'S hypothesis (2) of multiple allelomorphs for colour is not in agreement with the results obtained, for whereas according to him, the various possible factor combinations (3) would be 2 blacks **BB** (homozygous or **BR** black (heterozygous) : 1 **BL** dun : 1 **RL** yellow, the obtained results were 2 black **BB**, or **BR** : 5 **BL** : 2 **RR**.

Dun is dominant to black, but the experiment has not shewn whether the dominance is due to a simple epistatic factor or a factor capable of modifying colours other than black.

80 — **Zoometric Data for the Pure-Bred Foal at Different Ages. Measurements taken in the United States.** — HOOPER, I I, in *The Breeder's Gazette*, Vol. LXXX, No. 8-2072, p. 251. Chicago 1921.

Measurements taken at the Nursery Stud farm at Lexington, Kentucky. The figures are given in the following Table :

(1) GOWAN, J W, Studies in Inheritance of Certain Characters of Crosses between Dairy and Beef Breeds of Cattle, in *Journal of Agricultural Research*, Washington XV, 1, 1918. (Ed.)

(2) WILSON, J., The Colours of Highland Cattle, in *Sci. Proc. Roy. Dublin Soc.* Vol. VII (No. 5) (1909). — IDEM, *A Manual of Mendelism*, London, 1916. (Ed.)

(3) The three factors concerned in this experiment were **B** (black), **R** (red) and **L** (Light-dun). (Ed.)

Date of measurement	Average for 10 colts				Average for 10 fillies			
	Height	Circumference of chest (1)	Live weight	Average increase in weight per month	Height	Circumference of chest	Live weight	Average increase in weight per month
	cm.	cm.	kg.	kg.	cm.	cm.	kg.	kg.
24 hours after birth . . .	104.18	85.73	—	—	103.51	83.82	—	—
November 1 <sup>st</sup> . . . . .	137.08	140.97	259.00	—	138.53	143.51	252.65	—
December 1 <sup>st</sup> . . . . .	140.89	147.32	285.31	26.31	140.36	146.05	276.24	23.59
January 1 <sup>st</sup> . . . . .	142.92	149.86	303.00	17.69	142.24	148.59	296.19	19.96
February 1 <sup>st</sup> . . . . .	145.42	153.04	318.87	15.88	144.10	153.67	309.80	13.61
March 1 <sup>st</sup> . . . . .	147.32	156.84	335.20	16.33	146.05	156.21	322.05	12.25
April 1 <sup>st</sup> . . . . .	147.32	161.29	353.80	18.60	147.32	159.39	344.43	22.68
May 1 <sup>st</sup> . . . . .	151.13	163.83	377.84	24.04	149.22	161.93	363.33	18.60
June 1 <sup>st</sup> . . . . .	151.13	164.47	391.45	13.61	151.77	165.74	384.64	21.32
July 1 <sup>st</sup> . . . . .	154.31	167.01	418.21	26.76	151.77	166.67	410.04	25.40
(At the age of 15 months)								

(1) Measured from just behind the olecranon process and the withers.

81 - **The Stock-Breeding Institute of Sidi-Tabet, Tunisia.** — GINIEIS (Directeur de l'établissement d'élevage de Sidi-Tabet), in *Bulletin Mensuel de l'Office du Protectorat Français, Tunisie*, Year XIV, No. 122, pp. 81-93; No. 123, pp. 97-100; No. 124, pp. 113-116; No. 125, pp. 129-131. Paris, June-September 1921.

The author describes the organisation of this Institute, its objects, programme and work, as well as the progress it has already made.

The estate of Sidi-Tabet, which covers an area of 5 200 hectares is situated in the valley of the Medjerdah, 22 km. north-west of Tunis. Originally granted in 1866 to Count DE SANCY who established a Stud Station, the estate was made over to the "Société Franco-Africaine" in 1880.

In 1913, the Agricultural Authorities bought back the property with the object of founding a Stock-Breeding Experiment Centre.

I. ORGANISATION. — The land devoted to this Institute includes about 500 hectares in the plain and 146 hectares of mountainous or hilly country and is divided into two distinct areas situated on the banks of the Medjerdah, one at Sidi-Tabet and the other at Sidi-Ali. Although inconvenient in many ways, this division of the estate has some advantages. For instance, it allows the establishment of 2 autonomous farms. Sidi-Tabet will be the Experiment Station, the experimental farm devoted to the stud stock, breeds, élite individuals. Sidi-Ali will be the "economic" farm, the two farms being complementary from the financial, and technical standpoints.

II. OBJECT OF THE INSTITUTE: ITS PROGRAMME AND THE MEANS OF CARRYING IT OUT. — The first aim of the Institute is to study the theoretical and practical questions connected with stock-breeding in the colonies and to direct the systematic improvement of stock in Tunisia. Its work essentially consists in determining the best methods of keeping,

breeding, using and improving the native animals, solving certain difficult questions connected with stock-feeding in the colonies, finding the profitable equilibrium that should be maintained between stock-raising and crop production on an agricultural farm and finally supplying the colony and also foreign countries with élite animals for breeding purposes. These objects should be attained by carrying out the following programme : 1) strict selection of the native breeds ; 2) crossing the breeds of the country with carefully chosen imported breeds ; 3) maintenance of the purity of the breeding stock imported for improvement purposes. A comparison of the results obtained with each of the above methods should bring to light the most advantageous for general use in the country. In addition to the technical problem of the best means of obtaining good class stock, there is the still more important economic question which is solely concerned with the financial side of the operations. This forms the second part of the programme drawn up for the Station.

On the other hand, in order that they may be of general application, it is necessary in difficult experiments such as those connected with the improvement of stock, to take into account the average agricultural and stock-rearing conditions of a country. Hence and in order to carry out the economic programme, it was decided to have an agricultural farm annexed to the Station.

Finally it was recognised that no experiments could be complete or lead to the general improvement of stock, unless they were carried out on a large scale and with a number of animals of every species. In the remainder of the article, the author gives a complete account of the programme to be adopted in the case of the most important domestic animals (horses, mules and donkeys, and cattle), the work already carried out or in progress, the results already achieved and those still to be realised in the future.

III. HORSES. — The establishment of a Stud Station was the formal condition of the original concession made to Count DE SANCY by the Government of the Bey. He does not however seem to have made any attempt to improve the native horses, but to have wished to breed on the spot animals similar to those found in Paris. For this purpose DE SANCY imported pure-bred English, Anglo-Arab, Anglo-Norman, and even Scottish stallions and brood-mares. Most of the foals bred were however Anglo-Arabs.

During its management of the Station (August 1880 to October 1913), the Société Franco-Africaine aimed successively at two different objects. Throughout the first period (1881-1897), it tried like DE SANCY, to produce a fine saddle-horse suiting the taste of the time, but some more selective experiments were also made on the Arab and Barbary breeds. No prevailing idea seems to have directed these efforts beyond the wish to obtain some unusually fine specimens, and no attempt was made to improve the breed of the country.

During the second period, the Society adopted a more systematic method. The objects of its work were then threefold : 1) breeding pure-

blood Arabs : 2) breeding the Arab-Barbary horse ; 3) breeding mules from the rejected mares.

The production of pure-blood Arabs and of mules gradually increased in importance, but the number of Arab-Barbary horses reared diminished.

The Agricultural Authorities, when they took over the Station, kept the best of the pure-bred Arabs only and sold all the Arab-Barbary hybrids and the Barbary mares.

At the Sidi Tabet Stud Station they continued : 1) the selection of the Barbary breed ; 2) the breeding of good saddle-horses by selection of the Barbary and Arab horses ; 3) the breeding of draught horses by the selection of powerful Barbary horses and the repeated crossing of Barbary mares with Breton Stallions ; 4) the selection of the Tunisian pony.

1) As a result of numerous and varied crosses the Barbary breed tends more and more to disappear, and there is a risk of its being ousted by a heterogenous " population " with no fixed characters. Owing to its thriftiness and powers of resistance, the Tunisian-Barb is however superior to any of the other hybrids that have been obtained. This cross supplies excellent horses and brood-mares, many of the animals having size and bone.

Most of them are remarkable for depth of chest and powerful fore-quarters. In all cases however the hind-quarters are weak and badly-balanced, the croup being depressed, short, sharp and narrow and the hocks close and crooked. These defects can be remedied ; by liberal and regular feeding the dimensions of the breed can be expanded and the faults of the hind-quarters can be corrected by careful selection.

2) — a) The preservation of the native race is now more important than ever, seeing that the World War has proved the Barb to be one of the best of cavalry horses and an ideal mount for the trooper. By choosing and mating short, symmetrical, regular, short-legged individuals showing traces of good blood and breeding, an excellent saddle horse could doubtless be quickly obtained.

b) In addition to the Barb, pure Arab horses are also selected at Sidi-Tabet. Under the influence of the dominant idea originally governing horse-breeding at the Station, viz., the production of a fine mount, the main object in view was to obtain an elegant, tall horse of pure Arab blood with long lines. Remarkable specimens were bred which made the reputation of Sidi-Tabet throughout North Africa and supplied superb stallions to the Army Stud Stations. On taking over the Station the Authorities made every effort by selection and choice of sire to improve the former type, which is still preferred by many breeding experts, and at the same time to obtain a new type of average proportions, thickset, standing low, symmetrical and regular, recalling to a greater extent the classic Arab of the East.

c) In short, a comparison of the Barbary and selected Arab horse will show which animal is the better as a saddle horse, and will certainly direct the efforts of the Tunisian stock-breeders towards the production

of the Barb. by means of rigorous selection, or the breeding of the Arab through repeated crossing.

3) Although the mule and the ox must remain the chief draught animals for agricultural purposes and the extension of motor culture will decrease the number of animal tractors required, it is certain that a good draught horse would be most useful to the Colony. No such animal exists at present but the Station will show that it can be obtained.

The type of horse chosen for agricultural purposes is the post, artillery or omnibus horse weighing 500 to 550 kg., from 1.50 m. to 1.55 m. in height, short, short legged and well-balanced. Sidi-Tabet is trying to obtain it by two different methods: *a*) by the selection of heavy Barbary sires and dams weighing 500 kg. and over, large, massive and with heavy frames; *b*) by the repeated crossing of the above type of mare with the small Breton horse from Cornouailles, or the poor cantons of Léon, which is the only animal possessing sufficient thriftiness and endurance to withstand the wretched climate of Tunisia; *c*) the comparison between the draught Barb and the Breton horse suggested as its substitute will decide which is the better animal. It will then be possible for Tunisian breeders to adopt the method that has given the best results with the least expense.

4) In addition to the Arab another local breed, the Cap Bon and Mogod pony, will be kept at the Station. The qualities of this animal are not to be despised in spite of its small size. The type will be improved by selection.

RESULTS OBTAINED. — By a careful choice of the stallions obtained from the best Stud Stations of Tunis and Algeria, Sidi-Tabet has been able to make progress in breeding pure-blood Arabs. The old type however while keeping its air of breeding, height and fine lines, has acquired the bone and flesh which was to some extent lacking, and has become more powerful, more regular and more symmetrical. It has also been possible to obtain some large mares with short legs and of average proportions which are remarkable for their balance, the regularity of their fine lines and have an expressive square head, broad at the level of the brow, a straight profile, and large full eyes.

Thus in all the new products, the blood has been improved, the knees and withers are lower and the lines of the head have fined down. The first results are therefore most encouraging.

By increasing care in the choice of the stallion, and by strict selection for the desired end, Sidi-Tabet will succeed in breeding a race of Arabs whose bright coat, fine lines, general shape and characters of head will increasingly reveal their Eastern origin.

The Station at the same time continued to rear the Barbary horse. Of the 5 Barbary mares from the districts of Ebba-Ksour and Thala, 3 are used for breeding large draught Barbs or Breton-Barbs. Their foals are still too leggy, flat and loosely built. The other two mares are light, slender, more symmetrical and represent a rather handsome type of cavalry-mount. Both these colts and fillies are not wanting in breeding and symmetry, but their general balance leaves something to be desired

The next purchase of Barbary brood-mares will be chosen for their symmetry and balance rather than for their height, and thus the value of these experiments will be increased.

Comparison of the pure-bred Arab with the pure-bred Barb has shown that the former is superior as regards symmetry, elegance of line, signs of breeding, suppleness and good paces. In addition to these advantages which were easy to foresee, and already well known, the experiment proved, at least at Sidi-Tabet, that the Eastern horse is thriftier and easier to keep than the native animal, although few persons are aware of the fact. Barbary mares and foals eat a third of a ration more (hay and grain) than Arab mares and foals of the same weight and age. The author is uncertain whether this is merely a coincidence or a natural predisposition, as seems likely from the difference of build. Further comparisons made with a larger number of subjects should settle the point.

In spite of the results obtained, the increased girth of the original Sidi-Tabet Arab type, the creation of a smaller, shorter, more symmetrical animal nearer the Eastern model and also the selection of the Barbary breed, there still remains much to be done.

IV. DONKEYS AND MULES. — The object of the Station in regard to these animals is to improve the native donkey, to determine the best jack-ass for mule-breeding and to acclimatise foreign breeds with a view to breeding stallion donkeys on the spot.

The native breed consists mostly of small animals, but it also produces a certain number of strong female donkeys and good sized jackasses and although not of much service for mule-breeding, is yet worth improvement. At Sidi-Tabet this will be done by selection combined with repeated crossing with the foreign breed that experience will show to be strongest and best suited for the purpose. Since its organisation, the Institute has possessed: *a*) Savoyard jack asses; *b*) Poitou jackasses; *c*) Pyrenean jackasses. During the time they spend at Sidi-Tabet, which is from June to the following February (1), these animals take part in all the agricultural work with the mules and oxen belonging to the farm. They have the same food, are exposed to the inclemency of the weather and subject to the same periods of over-work. The long spell of draught work proves their dexterity, resistance and good working qualities.

During the service season, a certain number of donkeys remain at the Stud Station to serve the mares of the Institute, as well as those owned by the colonists and natives. Many of the donkey stallions retained in 1921, during the time they were working, served two or three times; the number of mares covered being over 350. The qualities of these donkeys as sires is proved by this repeated use and by an examination of the mule foals of both sexes running with the mares in the douars of Sidi-Tabet.

The following conclusions are the results of several years' observation.

1) All the breeds of donkeys imported into the Colony suffer much

(1) During the service season, the donkey stallions are distributed among the Stud Stations of the Institute or kept by the Colonists. (Ed.)



from the stings of insects, summer sores or other skin affections, especially during the hot weather. Putting the animals to work is one of the best prophylactics and cures, for the donkeys thus escape the continuous irritation and the attacks of the flies.

Although resistance to skin diseases is more an individual than a racial character, the Pyrenean breeds appear to be the most immune. The thick coat of the Poitou asses although making them more disposed to eczema, protects them very effectually against flies. For this reason though the heavy coat of the Poitou female donkeys is removed the first year they spend at Sidi-Tabet, it is allowed to grow afterwards and never clipped even during the intense heat of the summer as it protects them from insect attack.

As regards good working qualities such as strength and hardiness, adaptability to climate and cost of keep, the Pyrenean and Savoyard breeds are incomparably superior to the Poitevin. This donkey is heavy, wanting in muscle, squat, soon tired and of clumsy gait and unable to do prolonged laborious work, and hence unfitted for ploughing or the long journeys required of transport animals. The Pyrenean and Savoyard donkeys on the other hand do all the work of the farm. Their greater strength is the only thing which distinguishes them from the native breed which is also very resistant. Work is beneficial rather than harmful to these imported donkeys, making them strong and docile ; it is also the best preventive and curative treatment of dermatosis and excites the sexual instinct of the stallions which become more ready and energetic in service.

The Pyrenean donkey readily becomes acclimatised to Tunisia, living and working like the native ass or mule. The Poitou donkey becomes fairly easily acclimatised and does well if worked moderately, but cannot stand hard and continuous exertion.

The former is not only more resistant but also more profitable to the farmer, who finds in his Pyrenean donkey a powerful stallion as well as a worker paying for the greater part of his keep.

The two breeds differ in their capacity for reproduction in the same manner as in their aptitude for work. The Pyrenean jackass (like the Savoyard ass) is relatively ardent, whereas the temperament of the Poitou stallion is colder, the mare has to be kept with it and often there are long periods of waiting before copulation. The productive capacity is difficult to estimate, and depends upon the female as much as upon the male, being especially affected by the state of "heat" in the mare. At Sidi-Tabet, none of the breeds showed any characteristic difference in this respect.

The heaviest mortality has been found among the Poitou donkeys which are more liable to skin complaints and predisposed to chronic splitting of the hoop.

The Pyrenean jackass is indisputably superior to the Poitevin on account of its lower price, the fact that it can be used as a work animal as well as a stallion, its sexual ardour, lower disease and death rate, and

the favour in which it is held by the Arabs, and should certainly be recommended for mule-breeding and for the improvement of the native stock. Further experiments will show whether it can hold its own against the Syrian donkey, or even the improved native donkey.

**MULE-BREEDING INDUSTRY.** — Since the foundation of the Institute some of its Arab and Barb mares have been served by Pyrenean and by Poitou donkeys. These experiments taken in conjunction with the results of numerous observations made on the mules out of native mares served by Sidi-Tabet or native asses have led to important conclusions. Arab brood mares mated with Pyrenean and Poitou donkeys produce fine, strong, symmetrical, quick, docile, well-balanced mules with long free paces.

Mules out of Barb mares are slighter, show less marks of breeding, are sometimes slightly crooked in the hocks and have shorter paces. This first series of experiments thus proves that the substitution of the Arab for the Barb would not decrease but rather improve the mule-breeding qualities of the native race.

The facts regarding the best donkey stallion are even more definite. The jackass of the country sires nervous, narrow framed, small mules, which are so much inferior to the products of the same mares when mated with Pyrenean donkeys that an increasing number of natives take their brood-mares to Sidi-Tabet, in order to have them served by the donkeys belonging to the Institute.

The mules out of Poitou mares are short, squat, thick-set, short-legged and clumsy-looking on account of their large heads, and will perhaps prove susceptible to summer sores and the stings of flies. They are as yet too young to be put to work. Here again the Pyrenean male donkey shows his superiority. His offspring may be lighter and slighter than the progeny of the Poitou donkey stallion but they are taller, quick, wiry, agile, strong and resistant and when 4 to 5 years of age, they seem indefatigable. During the summer of 1921, they stood the trying work of hay-making, harvesting and ploughing quite as well as the native donkeys.

The Savoyard donkey has sired excellent mules showing great powers of resistance, even in S. Tunisia.

The proposed programme is far from being completed. Not only have the experiments hitherto made been too few and of too recent date to warrant any definite conclusions, but it will also be necessary to carry out numerous additional experiments with the breeds of mares and jackasses already at the disposal of the Institute, as well as to try mating Breton × Barb hybrids with Syrian donkey stallions.

**V. CATTLE.** — The author confines himself to the programme for the improvement of cattle, which is much more complex than that for the improvement of the horses and includes a number of difficult, intricate and interdependent questions chiefly connected with the factors of environment. Many experiments will have to be undertaken with the following objects: 1) the discovery of the best animal; 2) the study of the different principles to be observed in cattle rearing. Improvement

will have to be effected by selection combined with crossing. The native animal is worth selection as it is not without good qualities. Thickset and short legged, it is remarkable for the height and width of its chest, which is only a little above the ground, its broad ribs and powerful, solid, muscular fore-limbs. Unfortunately its hind-quarters are distinctly bad, the croup being short, sunken, narrow, the thigh thin, the haunch sharp and flat, the legs slender, and the hocks close and crooked.

With all these defects, the Tunisian ox is still a first class draught animal. Its small size hides an unusual degree of strength, it can resist privations and heavy work to an extraordinary extent, and its qualities as a producer of beef though not so good are not negligible. It fattens with surprising ease and rapidity, but it is late in coming to maturity, and its meat is tough and deficient in flavour. In spite of their finely shaped udders the Arab cows give but little milk. Most of them only yield 4-6 litres a day, though some supply as much as 8-10-12 litres. Their defects chiefly depend upon the wretched way in which they are managed. Under more satisfactory conditions, the animals could perhaps be improved and the milk yield increased to the point of making the keeping of Arab cows a profitable undertaking.

As always happens, selection will remain the favourite method, for it is the easiest to carry out, the most economical, and the surest in its results.

As regards crossing, the difficulties though by no means slight are less in the case of cattle than of horses. The chief point is to ascertain whether the work will pay, and to be sure that the care, trouble and outlay entailed will meet with an adequate return.

Of the various systems of crossing, continuous crossing will be tried under all the given conditions with the object of a permanent improvement in the appearance of the animals. Industrial crossing will merely be practised for commercial purposes, and only in very rare instances will recourse be had to alternative crossing and the rearing of half-breeds.

82 - **Live-Stock Industry in Fiji.** — RAINEY, W., Agricultural Circular issued by the Department of Agriculture, Fiji, Vol. I, No 7, pp. 119-132. Suva, 1920, in *Tropical Veterinary Bulletin*, Vol. IX, No. 3, pp. 183-188. London, August 1921.

LIVE STOCK

The approximate numbers of livestock in Fiji are :— Cattle, 80 000 — horses and mules, 10 000 — sheep, 1 000 — goats, 6 000 — and pigs, 4 000. The annual birth-rate of cattle is estimated at 10 000. On subtracting the animals killed for meat, exported, or dying from disease, we have a net increase of 2 000 head per annum.

CATTLE. — The supply of meat exceeds the demand, and consequently the price paid to the grower is low, but there is not sufficient excess at present to allow the development of an export trade.

In view of the cost of clearing, cultivating, fencing and weeding, it is not profitable for Europeans to develop land for cattle production, except as a side-line in coco-nut plantations. The supply of cattle is kept up

and increased by the Indian small-holder, who on an average has two cows and two working bullocks. The average weight of a 3 to 4 year-old bullock is from 300 lb. to 400 lb., and the average price per beast is £7.5. at Suva, or, £6.25 at Lauvoka. The average carrying capacity of the best flat land in the wet belt of Fiji is one animal to the acre. The only profitable form of cattle farming for the European grazier would be to purchase mature cows and store bullocks for fattening purposes. There are few self-supporting grazing-grounds and these are on river flats with Para grass (*Panicum molle*) for pasture. The scope for more graziers is therefore limited; it would be difficult to make a success of cattle-farming in the dry belt, on account of the small number of pastures available for fattening without handfeeding.

It is unlikely that the Islands can compete with temperate climates in the export of butter for the world's market. There is however good reason for assuming that the percentage of butterfat in the milk of the Fijian cow is actually higher than could be obtained in temperate countries from a similar class of cow under the same conditions of feeding.

Practically the only export trade is the shipment of a few bullocks each month to the butchers of Tonga and Samoa.

One enterprising commercial firm has built up an important trade in the victualling of ships with fresh meat and has in hand the experimental breeding of Indian cattle on a large scale.

A cross between the Zebu (Indian bull) and a European strain of cattle is most likely to prove the best breed for Fiji, except for high grade dairy farming, for which purpose a pure strain of Holstein will probably give the most satisfactory results.

The dry belt although it affords no hope of further development for cattle, still offers good prospects of development as a sheep country, but further investigation is needed to ascertain whether ewes are profitably fertile in Fiji.

**HORSES AND MULES.** — It is considered that these islands can supply themselves with both horses and mules, provided reasonable care is observed in the breeding and feeding of foals. Draft horses are chiefly in demand, and should be bred from the Suffolk Punch or Percheron strains. It may however be found on examination that it does not pay to breed horses in Fiji, when a great horse-breeding country like Australia is near and ready to supply any number of animals at moderate prices. On the other hand, it ought to pay well to breed mules (which could easily be done by mating good imported jack-asses with good country-bred mares), and these animals are considered the most suitable for the conditions of plantation work.

**LIVE-STOCK DISEASES.** — The author mentions the following diseases as being of common occurrence in Fiji: 1) *bovine tuberculosis*: the number of infected animals varies from 2 % in some parts of the dry belt to 20 % in some parts of the wet belt. — 2) *Ulcerating tumours of the eyes and back of cattle and legs of horses*. These tumours are due to the infection of sores caused by a larval nematode (apparently *Habro-*

*nema*) ; the disease is known as "Tona" in Samoa — 3) *filariasis* of dogs — 4) *Mange* — 5) *Scour* in calves — 6) *Osteoporosis* in horses.

PASTURAGE. — Remarkably little progress has been made in the cultivation of good grass. The only valuable pastures at present consist of Para grass growing on alluvial land. The grasses best suited to local conditions seem to be those of the *Panicum* family. With the exception of a small-leaved trefoil, Para grass, Guinea grass (*Panicum maximum*), and an upland variety of *Panicum*, there appear to be no grasses growing and propagating naturally in Fiji that are worth cultivating. Buffalo grass (*Buchloe dactyloides*) has been introduced experimentally and appears to do well, Rhodes grass (*Chloris Gayana*) is also being tried.

CONCLUSION. — In the author's opinion, the future of the cattle trade in Fiji depends upon several factors, of which the most important are the following : 1) the discovery of suitable grasses for upland pastures — 2) the control of weeds, especially of *Clidemia hirta* — 3) the establishment of a remunerative opening by means of a freezing or canning factory — 4) the creation or improvement of roads.

83 — **The Live-Stock of Italian Somaliland: Census of February 1, 1921.** — *Mimandro delle Colonie, Ufficio Affari Economici, Bollettino di Informazioni*, Vol. IX, Nos. 4-5, pp. 278-280. Rome, May-June, 1921.

The live-stock of Italian Somaliland is fairly numerous as is shown by the census of February 1, 1921, which was taken by counting the animals at the watering-places and gave the following figures :

*Live-Stock of Italian Somaliland.*

	Upper Uebi Scebelli Commis- ariat	Middle Uebi Scebelli Commis- ariat	Lower Uebi Scebelli Commis- ariat	Upper Juba Commis- ariat	Totals
Camels . . . . .	181,578	105,822	97,485	1 716,793	2,101,678
Cattle . . . . .	160,574	262,059	273,805	550,023	1,246,461
Sheep . . . . .	436,269	286,445	323,157	520,337	1,566,308
Horses, donkeys, and mules .	4,360	3,896	621	2,171	11,048

84 — **The Val di Chiana (Tuscany) Breed of Cattle and its Improvement** (1). — LAMBARDI, M., in *Giornale di Agricoltura della Domenica*, Year XXXI, No. 49, p. 389, figs. 2. Piacenza, December 4, 1921

The "chianina," or Val di Chiana breed, is the tallest of all the Italian breeds of cattle. Its home is in Central Italy (Tuscany and part of Umbria), but it has been introduced, for the purpose of improving the stock, into other parts of Italy including Umbria, Romagna and the Marches. This breed is of pure local origin, as was shown by Dr. Francesco MARCHI in "Atavismo nella razza bovina di Val di Chiana" and by Prof. Ezio MARCHI in "Razza bovina di Val di Chiana." It has been obtained by the progressive improvement of the local race brought about by the better conditions of environment and feeding and the introduction of proper housing which were the results of draining the valley in 1830. The occur-

rence of albino individuals, called "mucchi," is attributed by D<sup>r</sup>. F. MARCHE to an excessive amount of refinement; depigmentation is to be observed in all breeds of cattle that have been improved to the highest point, as is shewn by the Charolais race. As the number of "mucchi" had risen to the high figure of 25 %, the Val'di Chiana breeders decided to use for sires, less highly bred bulls that possessed all the characters of the race to a marked degree. It was found that none of the offspring of these animals proved to be "mucchi," which explains the fact that in hilly districts where the breed is hardier, the phenomenon of albinism is unknown. The "mucchi" are well-formed and good meat producers but have little capacity for work.

One of the objections made to the breed is that the animals are too long-limbed, a defect however which does not exist in the cows or bulls (that is to say the selected males), nor in the finest oxen.

The example set by buyers from other parts of Italy who choose the shorter-legged bulls for improving their stock has found imitators in the original home of the Chianina breed, so that the defect of excessive length of limb is disappearing to the great advantage of the beef and working qualities of the animals.

The author advises the breeders of the cattle to collaborate and draw up a Herd-Book.

85 - Comparison between the Milk Yield of Young Cows and Mature Cows. Researches Made in the United States. — HOOPER, J. J. (Department of Animal Husbandry, University of Kentucky, Lexington, Kentucky), in *Journal of Dairy Science*, Vol. IV, No. 5, pp. 451-452. Baltimore, September 1921.

With a view to determining the milk yield of a mature cow from its performance when young, the author studied all the results of the official milk yield competitions (for which 800 dairy cows had been entered) in the United States. The data collected are given in the following Table;

*Comparative Annual Milk Production of Young and of Mature Jersey Cows.*

Age of cows	No. of cows	Annual milk yield	Milk yield expressed as % of maximum production	Animal fat yield per cow	Fat yield expressed as % of maximum production
2 years. . . . .	278	3042 kg	74 %	153 kg	73 %
3 " . . . . .	126	3400	82	163	81
4 " . . . . .	112	3733	91	204	94
5 " . . . . .	91	3729	91	200	92
6 " . . . . .	60	3851	94	209	96
7 " . . . . .	47	4095	100	216	100
8 " . . . . .	29	3971	97	210	97
9 " . . . . .	25	3954	97	216	100
10 " . . . . .	11	4031	98	211	97

(1) See R. ZAPPA, *The Cattle Industry in Italy at the Present Day*, R. May 1914, pp. 772-783; R. June 1914, pp. 712-716. (Ed.)

This Table shows that a 2 year-old cow yielding 3042 kg. of milk, and 153 kg. of fat will give at the age of 7 years, when it has attained its maximum production and can be regarded as mature, 4085 kg. of milk and 216 kg. of fat. When it was only 4, however, its milk yield exceeded 90 % of the maximum production, so that after its third calving, a Jersey cow must be regarded as practically mature.

The maximum yield is maintained until the cow reaches the age of 10.

86 — **Methods Adopted for Improving Live-Stock in Tunis.** — See No. 81 of this *Review*.

87 — **Cattle Rearing in Fiji.** — See No. 82 of this *Review*.

88 — **Turkey Rearing in Sologne, France.** — DELAMARE DE MONCHAUX, in *La Vie aux champs*, Series III, No. 23, pp. 11-12. Paris, November 1921.

POULTRY

The enquiries made by the Central Agricultural Committee of Sologne, together with the Report presented to the World's Congress of Aviculture held at the Hague, and the figures furnished by the Chief of Commercial Services to the Orleans Railway Company show that shortly before 1914, 600 tons of turkeys were annually dispatched on an average from the principal Stations of Sologne, the maximum and minimum consignments being respectively 800 and 500 tons.

Taking the average weight of the birds (males and females), at 6 kg. per head, the number of turkeys annually sent to England, one year with another, is reckoned at 600 000, without counting 100 000 destined for other markets.

In order to supply the local demand and have sufficient turkeys for breeding purposes, the number of these birds kept before the War in Sologne was very large.

In 1918 and 1919, the export figures fell to 50 tons but rose again in 1920 to 150 tons.

There are many commons in Sologne, which are a great assistance to the turkey-breeding industry. Although the substratum of clay beneath the Orleans sands retains the rain-water, thereby causing damp and fogs which are unfavourable to poultry-rearing, the splendid results obtained before the War prove that the turkey-breeders have learnt how to triumph over these obstacles. They do not allow the birds to be out late, for the fogs that often arise at nightfall are very injurious to young turkeys. Careful hygiene and a strengthening diet help the chicks to get over the "crise rouge." Laboratory experiments are now being carried out for the purpose of discovering the cause of this disease which seems to be a perityphlo-hepatitis due to the presence of intestinal round worms belonging to the genus *Heterakis*. The author has himself frequently found this worm ("ver rouge") in turkeys attacked by the "crise du rouge". Diphtheria has also often caused the death of many turkeys.

In spite of the difficulties attending turkey-rearing, it may again become a flourishing industry in Sologne. Fat turkeys are bought by

the flock from the breeders by merchants who kill the birds and send them in crates to London. A certain number of turkey-hens are sent to Paris. They are smaller birds than the cocks, but more delicate. Before the War, the Sologne Committee tried to improve the conditions of sale, killing and dispatch by making a tariff with prices proportionate to the weight of the birds (the fine specimens being marked at a higher rate), and by substituting sale by weight for sale by flock. The Committee also advised the use of isothermic cars which would prevent any fear of the turkeys not arriving fresh in years when the weather was mild.

All these schemes were interrupted by the War. It would be advantageous both to breeders and merchants if they were now carried out.

Sologne turkeys in London find serious competitors in the Italian turkeys which are smaller, but earlier birds.

The French breeder would have to defend and protect his trade in this market.

89 - **Shortening the Incubation Period by Exposing Eggs to Radium Emanation; Experiments Made in Austria.** - WIENINGER, EG, in *Wiener Landwirtschaftliche Zeitung*, Year LXXI, Nos 92-93, pp 461-465. Vienna, November 19, 1921.

A communication made by the author to the World Congress of Aviculture held at the Hague in September 1921 (1). It gives the results of his five-years' researches undertaken to determine the effect exercised by a radium emanation upon incubation : 1) in an incubator with a constant supply of hot water ; 2) in an incubator heated with hot air ; 3) under a broody hen.

The hygroscopicity of the air in the incubators being from 55 % to 65 %, the temperature varied from 38.3° C to 40.6° C.

In order to expose the eggs to the emanation, the bromide of radium enclosed in ebony boxes 2 cm. in diameter and covered with a thin sheet of mica, was introduced into the apparatus, 20 cm. above the eggs.

The experiments proved that the duration of the emanation and the amount of radium employed had no bad effect upon the hatching out of the chicks.

Of the artificially incubated eggs 95.2 % hatched, which is remarkable considering that the experiments were carried out from November to January which is, as a rule, a bad season for the fertilisation of eggs. Further, the incubation period was shortened by 4 to 6 days.

The chickens from the eggs exposed to the emanation were unusually strong and grew very fast ; at the end of 6 weeks, they had attained twice the size of the control birds.

The pullets began to lay after the 5th month and continued producing eggs almost without interruption from August to February.

As there is no difficulty of technique to be overcome, and only a question of obtaining the necessary amount of bromide of radium (50 to 100

(1) For detailed information, see the author's work : *Der Einfluss der Radiumemanation auf die Abkürzung der Brutdauer*. Neutitschein, L. V. Enders. (Ed.)



mg.), the author is of opinion that the process he describes could well be carried out, in future, in practical chicken incubation.

- 90 — **The Comparative Efficacy of Animal and Plant Protein in Stimulating Egg Production: Duck Feeding Experiments in the Philippines.** — GOSCO ANDRES, in *The Philippine Agriculturist*, Vol. IX, Nos. 8-9, pp. 195-207. Tables 8, bibliography of 8 works. Los Baños, March-April 1921.

Experiments previously carried out by KEMPSTER (1), ROBINSON (2), AHRENS (3), and FRODA (4), had shown that animal protein has much more effect than plant protein upon the egg-production of fowls.

With the object of determining which of the two kinds of protein gave the better results in the case of ducks, the author made an experiment, lasting for a year, at the College of Agriculture, University of the Philippines.

The birds used in the experiment were divided into two groups, A and B, each containing 9 ducks and 2 drakes. They were fed in addition to their basal ration (a mash of equal parts by volume of unhulled bran), snails and copra meal respectively.

Details are given as to the method of carrying out the experiment and the treatment and feeding of the ducks.

The birds of both groups lost in weight during the period of the experiment. The loss was however more pronounced in the case of the copra-meal fed birds.

Each bird in the snail-fed group consumed 39.26 kg. of mash and 21.30 kg. of snails between July 20, 1918 and July 19, 1919, while each bird of the copra meal-fed lot consumed 33.10 kg. of mash and 12.30 kg. of copra meal during the same time.

The ducks in group A laid on an average 71.95 eggs per head per annum, while the average number laid by each duck in group B was 24.39. The average weight of an egg was 57.81 gm. in group A and 54.30 gm. in group B.

The eggs produced in group A had a fertility percentage of 88.19 % while that of the eggs produced in group B was 79.50 %.

On the other hand, the mortality among the ducklings of group A was greater than among those of group B.

- 91 — **Silkworm-Breeding in Tripolitania.** — *Ministero delle Colonie, Ufficio Affari Economici, Bollettino di Informazioni*, Vol. IX, Nos. 5-6, p. 277. Rome, May-June 1921.

SERICULTURE

The earliest attempts in silk-worm-breeding in Tripolitania date back to the year 1915. They were undertaken in the first place in order to discover whether the country was suitable for silk-worm breeding and were

(1) See R. Nov. 1917, No. 1047. (Ed.)

(2) ROBINSON, I. H., *Principles of Poultry Culture*. New York, 1912, p. 586. (Ed.)

(3) AHRENS, A. B., A Study of the Effects of Cotton Seed Meal versus Beef Scrap on the Egg-Production, Fertility and Vitality of Poultry, in *Oklahoma Agricultural Experiment Station, Bulletin No. 122*, pp. 1-20, 1917. (Ed.)

(4) FRODA, F. M., A Study of the Effects of Animal and Plant Protein in Rations for Laying Hens, in *The Philippine Agriculturist*, Vol. VII, pp. 235-253, Los Baños, 1919. (Ed.)

carried on until 1920 with the object of determining whether the industry was likely to prove profitable.

At the same time the local Government took steps to propagate among the natives the first principles of establishing a silk-worm-nursery and encouraged the cultivation of the mulberry-tree and the rearing of silkworms, thus laying the foundations of the sericultural industry.

The results obtained are as follows :

1) It is possible to have 2 rearings of silkworms a year in Tripolitania.

2) It is not necessary, as was once thought, to have special rooms built partly below the level of the ground.

3) The high temperatures due to the " ghibli " do not hinder the growth of the spring broods, for this wind has a favourable effect on the development of the silkworm and makes them more active.

4) Few of the natives in the Tripoli oases interest themselves in silkworm-breeding. The apathy of the great majority of the agriculturists has not yet been completely overcome by the large profits to be derived from the industry which needs great attention, although during a very short season only.

Sericulture in Tripoli has not yet attained the importance that is in store for it ; there are not many mulberry-trees in the country, and the few that exist are used by the agriculturists for other purposes. The Colonial Government continues to supply a large number of mulberry trees gratis, but it will be some years before the results of this assistance manifest themselves to their fullest extent.

92 - **Introduction of Sericulture into Colombia.** — *Revista nacional de Agricultura, Organo de la Sociedad de Agricultores de Colombia*, Vol. XV, No 205, pp. 3-6 Bogota, July 1921.

The " Escuela Superior de Agronomía y Medicina Veterinaria " of Medellín (Colombia), has begun the cultivation of mulberry trees, and has already planted about 900 with the idea of undertaking experiments in sericulture and of encouraging the spread of the industry in Colombia.

At Chinácota (Santander del Norte), a Jointstock company called " Compañía sericícola del Norte " has been started for the purpose of introducing and practising sericulture in the Municipality of Chinácota, in the Province of Ricaurte and in the Department of Santander del Norte.

In the Department of Santander the mulberry-tree is already grown, some of the landowners having several thousand trees. The few silkworm breeding experiments hitherto made show that sericulture is like to be very successful in Colombia.

93 - **The Possibilities of Rearing the Eri Silkworm *Attacus ricini* in Egypt** (1). — ADAIR, E. W., in *Bulletin de la Société entomologique d'Egypte*, 13th year, pp. 101-103. Cairo, 1921.

The author has succeeded in rearing Indian Eri silkworms (*Attacus ricini*), in Egypt, a country which he considers fairly suitable for silkworm-

(1) For the cultivation of *Attacus ricini* in Ceylon, see R. Feb. 1921, No. 189. (Ed

rearing, especially North Nubia from Assuan to Wady Halfa. In this region, which is very poor, large numbers of castor-oil plants are grown, and the wives and children of the natives employed in Cairo and elsewhere as servants would have plenty of time to tend the worms and wind the silk.

As however sericulture is more an economic than a biological question, the author lays stress upon the fact that, before urging the fellah to start silkworm rearing, he would require to be shown that his work would be remunerative, entail little expense, that the silk would find a ready market, and also that the time and labour necessary could not be turned to better account.

Experiments in silkworm breeding on a small scale have proved that the work can be carried on throughout the year in the region of the Delta, and during the winter months in Assuan. The author says however that if the industry is ever to become established in Egypt, it will be necessary to rear silkworms on a large scale in Nubia during the winter, and on a small scale in Cairo during the summer, in order to obtain eggs for the following winter, as the eggs of *Attacus ricini*, unlike those of *Bombyx mori* cannot be kept from one season to another.

ADAIR made many attempts before he succeeded in obtaining the silkworms. As the worms hatch out after 7 to 20 days according to the temperature, it was impossible to have the eggs sent from India, and the cocoons were forwarded in boxes large enough to allow the moths to emerge and mate on the journey. The changes of climate, especially during the crossing of the Red Sea, nearly always killed the chrysalids, or hastened the hatching of the worms, and it was not until 1917 that he received eggs laid en route and unhatched. Two Tables are given showing respectively: 1) the average number of days necessary for development at different stages and seasons (egg 10 to 20 days: larva 20 to 82 days: cocoon 19 to 48 days); 2) the average weight of 100 cocoons (from 39 to 50 gm.), and the number of cocoons per kg. (from 2000 to 4000).

## FARM ENGINEERING.

94 -- **The Power Farming Trial Week at Ondes, Haute Garonne, France.** -- BLANC, A. (Ingénieur du Génie rural, Chef de la Circonscription de Montpellier), in *Le Progrès agricole et viticole*, Year 38, No. 47, pp. 495-501, figs. 3. Paris, November 20, 1921.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

The Agricultural Office of the Sud-Ouest region held a trial week of power-farming from Oct. 12 to Oct. 17, at the Ondes College, near Toulouse.

The programme of this week included lectures, an exhibition of agricultural machines driven by electricity, and electric ploughing trials.

Two electric ploughing machines, both light windlasses with cables, were exhibited, viz., the DOUILHET windlass and the windlass of the Electric Motor Cultivation Society (S. F. M.).

The DOUILHET windlass is an extra-light machine. It weighs 750 kg.; its dimensions are about 1.30 m. × 1.20 m. × 2 m. The wheels are

provided with pneumatic tyres, and as therefore they have very little grip on the soil, the windlass has an anchor rod. The motor is of 12 H P and revolves under the tension of 220 volts. Two windlasses, one at each end of the field, send backwards and forwards a one-furrow two-way plough that can work to a depth of 20, 25 and even 30 centimeters. The possible traction of the cable is 300 to 400 kg.

The advance of the windlass after each furrow is effected by winding a steel cable on a drum fitted on the frame. One end of the cable is fixed to the drum and the other is fastened to a stake driven into the ground on the edge of the field. The drum is worked by hand by means of a winch, and the tractor travels on its cable.

In the absence of the makers, the windlass could not be tested.

The author is of opinion that the weight and power of the DOUILHET windlass are the lowest possible that can be used.

The machine is worked by 3 men, one at each windlass, and the third at the plough. Three men ploughing with oxen can each guide 2 pairs of oxen, or 12 animals in all: the work of an ox is the equivalent of 0.9 H P therefore, the work of 6 yoke of oxen guided by 3 men is equivalent to about 11 H P. Hence an electric machine worked by 3 men would not give as regards the man-power, a greater output than a team of animal-tractors of the same power. It has, however, one advantage, that of bringing to bear upon a single plough-share all the force of 11 H P, which is not possible when oxen are used, and is thus able to plough deep with one passage of the plough.

The S. E. M. windlass, 1921 type, although classed as a light tractor, is heavier than the DOUILHET, it weighs 3 tons and develops 35 H P, which means a little less than 100 kg. per H P and appears the minimum weight that can be combined with solidity. It works under a tension of 500 volts, and is self-working on the field.

The system of anchorage devised by ESTRADÉ, the Director of the S. E. M., is extremely simple: the inside wheels of the windlass (those on the side of the machine that is working), are furnished with cutting-disks forming, with the felly of the wheel, angle-irons of which the height is half the width of the felly. On the other hand, the cable on which the plough runs passes, before being wound on the drum, over a pulley fixed on the end of a pole coupled to the frame. This pole, which can move between 2 points, is kept in position by a pneumatic break. If a traction  $T$  is exerted on the cable the pole is drawn towards the base by a force  $F$  which opposes the force exerted by the brakes, the pole thus assumes such a position as to balance the two forces; if the traction  $T$  is increased the pole sinks further, so that a new position of equilibrium is assumed, and if the traction is sufficiently strong for the pole to reach its lowest limit, the current is cut off automatically.

By this arrangement the point of application  $O$  of the traction  $T$  varies on the axis of the windlass. The pneumatic brakes are so constructed, that whatever may be the position  $O_1, O_2, O_3$  of this point of application, the resultants  $R_1, R_2, R_3$ , of the corresponding tractions  $T_1, T_2, T_3$ , and

of the weight  $P$  always travel by the line joining the fellys of the wheels. All the force (weight and traction combined), to which the windlass is subjected thus falls on the fellys of the two inner wheels of the machine. Each of these wheels thus buries ("anchors") itself, in the ground, and presses the prism of soil between the felly and the cutting-disk, so that the windlass can only skid towards the cable in the plane  $mn$ . But in this case, the friction of the skidding is the friction of "compressed soil upon compressed soil", and it is shown by calculation, that this can only be brought about by exerting upon the cable a traction varying from 1.75 to 3 times the weight of the tractor, according to the nature of the soil.

If on the other hand the windlass were not provided with this arrangement of the pole and the cutting-disk, the skidding of the fellys (iron on soil), would take place with a traction force equal only to half the weight of the windlass.

In fact *ESTRADE*'S system of anchorage enables a tractor of  $P$  weight to stand a traction force at least 3.5 times greater than can be borne by an ordinary tractor of the same weight, which clearly means a great saving on the net cost of the apparatus. This tractor worked under extremely difficult conditions at Ondes, the dry soil being so hard that it required a force of from 2000 to 2500 kg to drag the two-way plough, though it was only ploughing with 2 shares and to a depth of 30 cm. The work was however done very regularly without any jerking.

The mechanical return of the machine is 78 %; with 2 windlasses it is possible to plough 3 hectares a day to a depth of 30 cm., and with the maximum of 100 kilowatt-hours per hectare, in the heaviest soils.

The price of the complete equipment of the two windlasses has not yet been settled, for they have not been made up in sets, but it may be estimated at about 75 000 francs.

The S. E. M. has tried to solve the difficulties connected with supplying the current on the spot and the exhibit at Ondes included a complete installation. The current is conveyed to the windlass by means of an "agricultural line", a fixed line formed of "black" stakes. These are stakes injected by a special process with a very large amount of creosote. The stakes seem to be practically permanent, for the S. E. M., has been using 20 000 for 16 years and none of them have required replacing.

Further they are non-conductors and, on "agricultural lines" at all events are able to carry the conducting wires without the use of insulators. It is also very easy to have a moveable electric switch on the ploughing ground. The initial cost of making a kilometer of the S. E. M. "agricultural line" is relatively low, and as mortgage can be spread over a great many years, the annual expense per hectare is much reduced.

In short, it was recognised at Ondes, that the question of ploughing by electricity had made considerable progress, and had passed from the theoretical to the practical stage.

The car of the automatic anchorage car devised by *BOYER* moves by means of the unwinding of a supplementary cable worked by the windlass.

Thus the car can be heavily loaded as it can be moved without hard work on the part of the men.

Various firms shewed on their stands in the Exhibition Hall different forms of electric apparatus. Among these should be mentioned, SOULE's apparatus for central supply stations for high tension lines — the motors of the Electro-Mechanical Co. — BOUT's motor-pumps — GRAMMONT's motors and china-ware — BROUSSARD and LARRES pumps. The S. E. M. exhibited their "galet de coincidence" which is already well-known and fulfils the following requirements.

1) It supplies a small low-power electric engine to fix on the frame of every machine for the home-work of the farm (root-cutter, straw-cutter, crusher etc.), and a means of working these small engines one after another, so as to increase the number of work hours of the electric force and decrease the power used.

The "galet" is an excellent means of transmitting current to such engines.

2) Provides a possibility, should there be any interruption in the system of distribution, of working by hand the low-power machines of the "galet de coincidence" which is started instantaneously with the greatest ease.

Among the machines made in the Toulouse district, the author mentions the OLIVES stacker, driven by electric engines and the LAPORT electric-lorry.

The lorry can carry 5 tons net weight and is provided with a battery of 1500 kg. accumulators, composed of 80 parts capable of supplying 250 ampère hours, or 160 volts. One charge of the battery, which costs 10 fr. is sufficient for a 65 km. run and is ample for ordinary farm transport work.

There are two types of battery, one of lead, costing 12 000 francs, and guaranteed for 2 years, and the other made of ferro-nickel costing 40 000 fr. and guaranteed for 10 years. The battery is connected with two motors of 10 HP each driving a wheel by direct contact. It is provided with 5 speeds, the highest being 20 km. an hour. The lorry in working order and fitted with a lead battery costs 45 000.

95 - **Trials of a Tractor Running on Poor Gas, in France.** — GREILSAMMER, R., in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VII, No 32, pp 606-701. Paris, October 19, 1921.

Trials were made on September 24, 1921, at Treuillaut near Chateauroux, with a CAZES gasogene, type D. L. 30 to 40 HP mounted on a TOUTRAND-LATIL tractor drawing a three-furrow plough working to an average depth and width of 1.05 m. and 0.15 m. respectively, giving a traction of 750-800 kg.

The engine of the tractor was of vertical 3-cylinder type with a 0.105 m. bore and 0.130 m. stroke; it developed 35 HP, ran at 1 200 revolutions, usually worked on paraffin and had not been modified in any way.

On the same ground and on the same day, a similar tractor running

on paraffin drew a 4 furrow plough at the same rate, which would seem to show that the loss of power due to substituting poor gas for paraffin was not above 25 %.

The objects of these trials were to determine the time taken, the coal, wood and water consumed and to observe the working of the engine.

*Time-taken.* — The trial on Sept. 24, lasted 4 hrs. 25 min. distributed as follows :•

Charging, lighting and ventilating at start . . . . .	23 min.
Ploughing proper . . . . .	2 hrs 52 "
Time on the way . . . . .	20 "
When not-hauling:	
At starting . . . . .	4 min
During ploughing . . . . .	10 "
After cleaning the radiator . . . . .	4 "
	17 min. 17 "
Stoppage for cleaning the radiator and supplying the scrubber with water . . . . .	22 "
Getting up speed after cleaning . . . . .	5 "
	4 hrs 25 min.

The following remarks should be made as regards these different times.

1) In addition to the time spent on the ploughing proper (2 hrs. 52 min.), which includes ploughing and turning at the end of the field (length 342 m.), the machine stopped on the way and on the grassland of the farm for 20 minutes, and was not hauling for 17 minutes counting the starting and various delays for regulating the plough or tractor during the course of the work.

In order to calculate the fuel consumption per hectare, the author reckoned the amount burnt in the 2 hrs. 52 min. while the fuel and water were also used in crossing the grass-land, when the machine was unoccupied, and also during the slow combustion for 1 hr. 50 min after the trial. The figures therefore are much higher than they should be, and would only be reached under the most unfavourable conditions.

2) The charging, lighting and ventilation at the start took 23 minutes only. The time was reckoned from the moment of beginning to fill the empty gasogene until the engine began to work. The actual time taken for ventilation was 21 minutes.

3) In the course of the work, an unavoidable delay was caused by the necessity for cleaning the pipe supplying water to the scrubber, which was stopped up with seeds and impurities from the washing water which had not been filtered before use. This fact is interesting as showing that the removal, cleaning and replacing of the radiator took 22 minutes only, and in spite of the introduction of air into the apparatus, a ventilation of 5 minutes was sufficient to start the engine.

4) The slow combustion for 1 hr. 50 min. after the test made it impossible to estimate the amount of coal remaining after trial which was burnt at a pure loss during this period.

*Estimate of surface ploughed and fuel consumed.*

1) Average speed of tractor: 27.30 metres per hour			
2) Surface ploughed . . . . .	<i>total</i>	<i>per hour</i>	
	7.85 ares	25.41 ares	
3) Wood (for lighting) . . . . .	<i>total</i>	<i>per hectare</i>	<i>per hour</i>
	5.580 kg.	—	—
Charcoal . . . . .	38 kg.	52 kg.	10.6 kg.
Water . . . . .	45 litres	62 litres	12.5 litres

The oil consumption was not measured, but it appears from the statements of the drivers, that a saving of 30 % was effected.

This is probably due to the fact that there is no partial combustion of the oil used, and therefore, as the author has found, the oil remains pure and preserves its lubricating power longer.

This is one of the interesting results of the use of poor gas from the economic standpoint.

VARIOUS OBSERVATIONS MADE DURING THE WORKING OF THE ENGINE. — The cylinders and plugs when examined after working were cleaner and less soiled with calamin than in the case of an oil driven engine.

The working of the engine left nothing to be desired during the trial, it started as easily, if not more easily, than with oil.

After working alone the engine started again without any trouble when the plough was attached; when the traction resistance was increased, the engine slowed down without any stoppage. In short it worked as well in every respect as a good engine running on oil.

*Conclusions.* — The figures given above show, that the charcoal consumption of a 35 HP tractor provided with a CAZES gasogene is 52 kg. per hectare at maximum. The charcoal was bought on the spot for 0.22 fr. the kg., and the fuel cost per hectare amounted to 11.45 fr.

Under the same working conditions, the engine uses 40 litres of oil (costing about 72 fr.) per hectare.

The saving realised is thus about 60 fr. per hectare.

In other words the expense of the fuel for a tractor driven by poor gas is 6 to 7 times less than if it were run on paraffin; the amount saved being about 85 %. This saving would continue, even if the cost of fuels were to fall to pre-War prices.

It should be mentioned that charcoal can often be bought at an even lower rate, especially in the Colonies, where it is sold at a very low figure, allowing a development of motor-ploughing to a limitless extent in the future in such countries. It may be hoped that poor gas will solve the problem of finding a cheap motor-fuel for agricultural traction and gradually replace the paraffin and petrol at present used for the purpose.



Tractors can be made to run on poor gas without changing the engine and with the simple addition of a relatively small gasogene (of 1 cubic metre) of moderate weight.

96 - **Mechanical Flax-Gatherers at the Show Held at Wattignies-lez-Lille, France.** - *Génie rural*, Year XIV, No 110, pp. 21-25, figs. 2 Paris, September, 1921.

In all branches of human activity, labour is a problem of ever increasing difficulty. The scarcity of workers coupled with the high and sometimes prohibitive wages demanded, cripple all industries, and are the chief causes of the decline of flax cultivation both in France and in other countries.

Great efforts have been made to extend the growing of flax and to substitute machines for hand-labour especially in gathering the crop. At the Wattignies-lez-Lille show, which was organised by the Departmental and Regional Offices of the North, and by the Flax-Growers' Committee of France, some improved mechanical flax-gatherers were exhibited, the principal models being two constructed respectively by Messrs MARSHALL, Sons and Co. Ltd., Gainsborough, and the firm of PUSH TOMBYLL.

With the first of these machines, the standing flax is gathered by means of a row of steel combs mounted on two metal endless belts.

The comb-carriers are furnished with rollers of soft steel turning on steel rails with angle-irons fixed to both sides of the machine.

At the back end of the machine, the rails are curved so as to form cams, or fixed eccentrics.

The divergence of the mechanism of the combs on passing over the fixed eccentrics causes a raising or retarding movement that sets free the comb-cleaners; in this way the combs are freed from the flax, which is not carried above the apparatus. The combs cut the flax below the machine.

In proportion as the gatherer is drawn forward by horses or a tractor, the combs beneath the machine pull backwards. This reverse motion reduces the danger of shelling that might occur if the crop were too ripe. The action of the machine is such as to leave all the weeds standing.

The teeth of the comb are so attached that in case of accident, they can be replaced on the field itself. The comb-cleaners make a kind of collar surrounding the row of teeth that form each comb. Cams or fixed eccentrics set in motion the arms of the cleaners. The latter begin work beneath and at the back of the machine, in order to remove the flax stalks pulled up and to clean the combs.

Each comb works independently as regards gathering and cleaning.

The machine is provided with a coupling supplied with clutch and spring for engaging and disengaging the combs and the lever working the coupling is placed within easy reach of the driver.

The frame of the machine is rigid steel and has 2 driving-wheels, one of which (the interior wheel) is geared for transmitting the movement to the gathering apparatus.

The output of the machine varies greatly with the condition of the field and crop, and also with the system of traction employed.

It can pull up the flax on an area of 2 to 4 hectares per day, the amount gathered varying according to the form of traction whether by

*Mechanical Flax Gatherer.* — MARSHALL, SONS & CO.

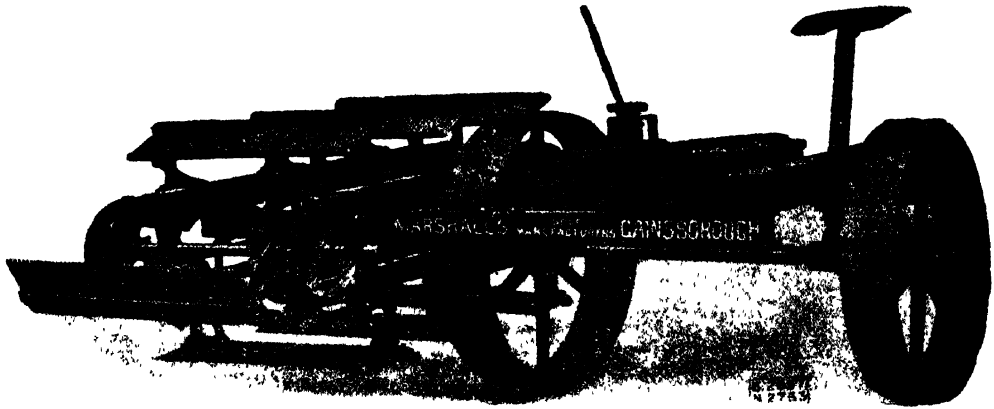


Fig. 1. — Front view.

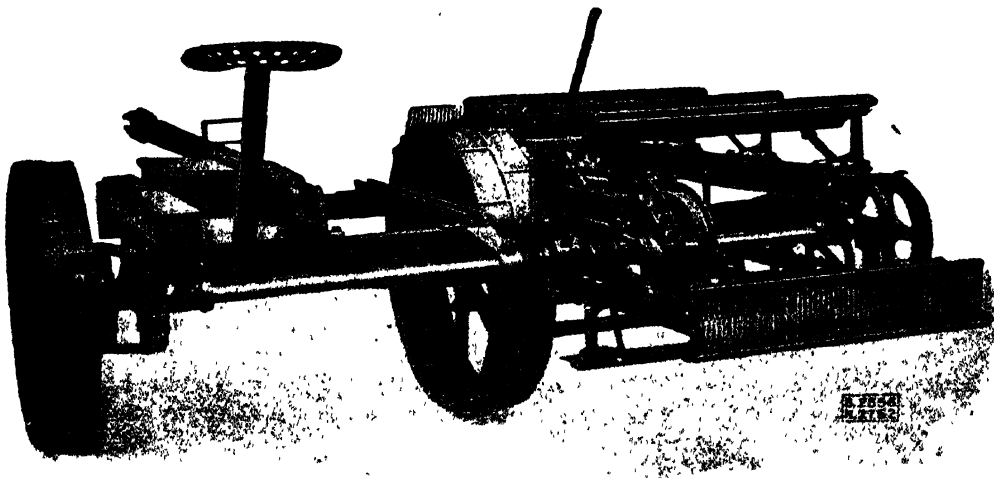


Fig. 2. — Backview.

horses, oxen or a tractor. All the machines sold in Scotland in 1920, gathered flax at the rate of 4 hectares a day.

The machine gathers the flax in swathes 90 cm. wide. It arranges the straw neatly on the ground behind it at regular distances apart.

The gathering-mechanism can be regulated as regards height and inclination to the ground, so as to suit crops with stalks of different length and the adjustments can be made on the field.

If a small tractor is used in preference to a draught-animal, it is possible to do the work with greater regularity, and in addition, the driver is able to direct the machine better in its course through the crop. The shafts are reversible and by a simple change in position can be used either for animal traction, or machine traction. The machine weighs about 920 kg., and can pass through a gate 2.75 m. wide.

During the flax season of 1921, these machines were used in the flax fields of England, Scotland, Ireland, India, British East Africa and Italy.

Messrs MARSHALL SONS and Co. Ltd. are the sole constructors and sellers of all the machines patented by the "Fibre Corporation Limited" for the treatment of flax. These include, not only gatherers but also shellers, capsule crushers, automatic strippers and dressers. Messrs MARSHALL make a special patented crusher of their own invention for rolling flax stalks.

The machines of the firm PUSH TOMBYLL (General Agent for France of the DESCARPENTIER-PETIT Firm at Lecelles, Nord), also took part in the trials at Wattignies.

The PUSH TOMBYLL firm have made a type of flax-gatherer mounted on a binder-harvester which, by a special arrangement of the binding apparatus, makes bundles the size of a good handful; the bundles are tied with a piece of hemp and then thrown to one side.

The gathering apparatus of this machine consists in rollers covered with rubber which are fixed at an angle of 45° with the ground. The flax is fed to the rollers by rakes placed in wheels and separated by steel plates forming a triangle, and it is pulled up by the rollers which work in pairs. After passing the rubber-covered rollers, the flax is caught by wooden rollers of a special shape and falls again upon a moving plane that carries it to the binder.

By means of these new machines, the problem of the mechanical gathering of flax has been solved, and the chief hindrance to the development of flax cultivation removed.

97 - **Wind-Mill with Coupled Wheels.** — RINGELMANN, M., in *Journal d'Agriculture pratique*, year 85, Vol. II, No. 43, pp 356-357. Paris, October 29, 1921.

The diameter of the wheels carrying the metallic sails of a windmill might be supposed to be a matter of indifference dependent solely upon the amount of resistance required. In practice this is not the case and the most usual diameters of these wheels are 2.40 m., 3 m. and 3.60 m.

At the British Royal Agricultural Show held at Park Royal in 1903, out of the 19 competing engines which all raised water 60 m. and had a wheel-diameter varying from 2.40 m. to 9 m., the 6 mills which gave the best results had wheels 4.80 m. in diameter. With a wind velocity of 4.47

per second (16.090 m. per hour), the water raised by these mills represented the expenditure of 19 to 24 hundredths of HP. One model is said to have developed about  $\frac{1}{2}$  HP. The results of the competition proved, that in raising water to the height of 60 m. the best returns are obtained with a wheel-diameter of 4.80 m.

The author knows of a plant in which there are 2 independent wheels each mounted on the summit of a pier. The two piers are connected



Wind-Mill with Coupled Wheels.

half-way up by a bridge passing above a building used for various purposes and containing a wash-house.

In a windmill connected with a house in Kansas 2 wheels of the same diameter instead of being carried each on a special pier, are mounted on a large cross-bar; the latter carrying one sail and one rudder: the cross-bar turns in the horizontal plane about the upper part of the pier. The accompanying figure is taken from a photograph of this mill with coupled wheels driving a powerful pump that fills a large reservoir with water used for irrigation.

## RURAL ECONOMICS

98 - **Cost of Producing One Quintal of Grapes in the District of Asti, Piedmont.** —

DALMASSO, G., and LISSONE, in *L'Italia vinicola ed agraria*, Year XI, No. 44, pp. 686. Casalmongerato, October 30, 1921

The following calculation was made by Prof. DALMASSO and discussed with Prof. LISSONE.

Cost of making a specialised vineyard (in the district of Asti), reconstituted with American stocks, using 5700 vines per hectare, to the end of the 3<sup>rd</sup> year; 39 000 *lire* per hectare. — Cost of one vine to the end of the 3<sup>rd</sup> year, 6.85 *lire*. Depreciation and interest on capital outlay, calculating the duration of the vineyard at 35 years, 2 775 *lire* per annum.

Cultivation expenses (114 days of male labour and 91 days of female labour per hectare, amount of depreciation, interest, etc.), 6 509 *lire* per hectare. With an average crop of 70 quintals per hectare, or 1.22 kg. per vine, which may be obtained from a reconstituted vineyard, the production cost of a quintal of grapes is 91.56 *lire*, or with a lower yield, more nearly approaching the usual average of 42 quintals a year, the production cost amounts to 152 *lire* per quintal.

On making a similar calculation from data collected in the neighbourhood of Alba, Prof. LISSONE found that in the vineyards of native vines with an average yield of 52 26 quintals per hectare (allowing for an average loss of 20 % due to injury from hail and *Cochylis*), the mean production cost of one quintal of grapes is about 130 *lire*.

## AGRICULTURAL INDUSTRIES.

99 - **Extraction of Grape-Pip Oil by Means of the Dutch "Tordoir"** (1). —

GRIMALDI, L., in *L'Italia vinicola ed agraria*, Year XI, No. 42, p. 653. Casalmongerato, October 16, 1921

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The "tordoir" constructed by the "Utrechtsche Machinefabriek", of Frans SMULDERS at Utrecht (Netherlands), which gives excellent results in extracting oil from seeds in general, had not previously been used for the extraction of oil from grape-pips. At the request of the author, the firm of SMULDERS carried out experiments with grape-pips giving the following results.

The grape-pips were treated by means of several kinds of apparatus.

1) A wooden sieve, with an internal aspiration — 2) a mill (Anglo-American system), with 5 superimposed cylinders — 3) a double-walled feeder for the heater — 4) a pip heater — 5) an oil press — 6) a mural pump — 7) a filter-press with chambers, or a bag filter — 8) drivingwheels and transmissions.

The operation is carried out as follows :

The grape-pips are cleaned in the sieve, or by an aspirator that removes the dust and other impurities. They are then transported to an Anglo-

(1) See R. July-August 1920, No. 797. (Ed.)

American mill, where they are crushed to the required fineness, the meal falling into the feeder which is affixed to the heater in which the pips are heated to the required temperature. The feed also regulates the entrance of the pips that are to be treated.

Before passing into the crusher the meal is always heated to between 60° and 65° C, which can be effected by introducing a steam pressure of about 3 atmospheres into the heater.

From a small quantity of grape-pips received from Italy, 16.65 % of oil was obtained and each charge was treated in 15 minutes. Therefore 180 kg. could be treated in 1 hour.

The residue evacuated by the crusher contained 7 % of oil.

The machine used about 15 HP. The oil is collected in a vessel and aspirated by a pump which drives it into a filter-press. If it is desired to dispense with the press, the oil can be passed through a filter with bags.

By means of this small experiment, the firm of SMULDERS discovered that their machine is very suitable for crushing grape-pips. If the operation were carried out on a larger scale, the return would certainly be higher.

100 - **Paraffin from Colza-Oil.** — MAILHÉ A., in *Comptes rendus de l'Académie des Sciences*, Vol. 173, No. 16, pp. 658-660. Paris, October 17, 1921.

In a previous work, the author has shown that the decomposition of linseed oil with a mixed catalyst (copper-magnesia), results in the formation of a gas of high calorific power and also of a liquid, which after hydrogenating with nickel at 180° C forms a mixed paraffin composed of formenic and cyclic hydrocarbons with a predominance of the latter.

Most vegetable oils behave in the same manner. Colza oil was decomposed with a copper-aluminium catalyst in a copper tube at a temperature of 550° C to 650° C and incondensable gases and a liquid were produced.

The gas which is very luminous, is composed of ethylene and formenic hydrocarbons and of hydrogen accompanied by carbon monoxide and carbon dioxide.

Two fractions are easily separated from the mahogany-brown liquid, one boiling at 150° C and the other at 250° C. The residuum on being again passed over the catalyst gives a fresh supply of both products.

After treatment with a dilute solution of sodium and with water both liquids were hydrogenated with nickel at 180° C. In one experiment, at the beginning of hydrogenation with active nickel, one part of the liquid distilling at 100° C to 120° C (density 0.7584 at 23° C), only contained cyclohexanic hydrocarbons with traces of formenic hydrocarbons. This liquid was not affected by the sulpho-nitric mixture, but when decomposed with nickel, at 350° C it formed benzine and toluene which were identified by their transformation into nitric derivatives, the residual nitration liquid having a density of 0.7210 at 21° C.

Hence it seems by using more or less active nickel for the hydrogenating

(1) See *R*, Nov. 1921, No. 1169. (*Ed.*)

reaction, it is possible to obtain at will a paraffin composed of both aromatic and cycloformenic hydrocarbons, or else of cycloformenic hydrocarbons alone.

101 - **Development of Indigo Industry in India and Nature of Changes Occurring during Extraction** (1). — DAVIS, A. W. (Indigo Research Chemist to the Government of India). I. Notes on the Development of the Indigo Industry in Assam in Conjunction with Tea and other Crops. — II. The Nature of the Changes occurring during the Extraction of Indigo from the Java Plant (*Indigofera arrecta*). — *Agricultural Research Institute, Pusa, Indigo Publications*, No. 8, pp. 17, and No. 9, pp. 76, tables 10, figs. 11. Calcutta, 1921.

I. — DEVELOPMENT OF INDIGO INDUSTRY. — The data given show the possibilities of indigo in Assam as compared with results obtained on the present badly deteriorated planters' estates in Bihar. Growth is evidently far more luxuriant in Assam, the yield of plants per acre amounting to from 200 to 300 maunds with a percentage of indigo-tin in the leaf of 1 % as compared with 50-80 maunds and 0.6 % in Bihar.

The author gives details of the actual yields of indigo at the first Assam indigo factory at the Panchnoi Tea Estate, established in 1919. WALTON (Acting Imperial Agricultural Bacteriologist) found by making bacterial plates by the indican-agar method (HUTCHINSON) that the water was as a rule extraordinarily deficient in the indican hydrolysing types of bacteria which it has been found are essential for good steeping results.

From tests already made by WALTON it seems possible to correlate the rate of growth of bacterial plates made on indican-agar with the time of steeping required, and it may be possible to adopt a method of this kind in ordinary factory control. The time required for steeping varies according to district, but once the best time for steeping is ascertained, it should give fairly regular and constant results. Much scientific work is still needed before control measures can be effected satisfactorily.

However, a method has recently been devised by the author and tested with success at Panchnoi. The test is colorimetric and by this samples of the extraction liquor in the vats can be compared at intervals of half an hour during the steeping; whilst the extraction is improving, and *before* the optimum time has been reached, successive samples show an increasing depth of blue colour when the test is applied as described in the Appendix; *after* the optimum has been reached, successive samples rapidly lose colour owing to the destructive changes which lead to the loss of indigo.

This method should obviate to a large extent the main difficulty of working indigo in Assam, namely, the variability of the water from day to day which necessitates a different time of steeping each day.

Owing to the extraordinary yield per acre of the indigo plant in Assam, the manufacture of indigo should be extremely profitable in this province, (at Panchnoi from 24 to 37 seers have been obtained per 100

(1) See R. Oct. 1921, No. 1057 and No. 50 of this Review. (Ed.)

maunds of plant ; these estimates were based on wet-cake measurement after pressing according to the customary Bihar basis of calculation). Data are given with regard to probable profits from indigo in Assam with different yields and different selling prices, and it is clear that a remarkable profit is obtainable.

With average working, yielding 20 seers of indigo per 100 maunds of plant, an output of 200 maunds of plant per acre would yield a profit of Rs. 275 per acre and an output of 300 maunds of plant a profit of Rs. 450. With very favourable average working (30 seers per 100 maunds) the calculated profits are Rs. 475 and Rs. 750 with yields of 200 and 300 maunds of plant per acre respectively. Natural indigo produced in Assam can with favourable working displace synthetic altogether from the market.

The actual cost of working with freshly cleared lands, which need much weeding and hand labour for sowing, cultivation and harvest, worked out at Panchnoi at Rs. 125 to Rs. 150 per acre. With higher acreage the expenditure would probably be less, especially as the land becomes freer from weeds : taking Rs. 150 per acre for 150 acres the total working costs would be Rs. 22 500.

The experimental factory to work 300 acres entails a cost (including the cost of the whole factory and machinery) of Rs. 50 000 and Rs. 55 000.

The author gives an outline of the existing markets for natural indigo, quoting China as a country where there is an immediate and active market waiting to be supplied with indigo in *its proper form* (" 20 % paste ") similar to that supplied by German producers. In recent years China and Japan alone have taken half of the entire European production of synthetic indigotin.

In the above calculations of profits no allowance has been made for the very marked value of the refuse from the indigo steeping vats (seet) as a manure for other crops ; indigo " seet " has exceptional value as a quick-acting nitrogenous manure for developing leaf growth. The development of tobacco in Bihar has been due almost entirely to the use of " seet " as a manure. There is no doubt that its use as a manure for tea would go far to reduce the very heavy outlay on nitrogenous manures which is now necessary. It could be used advantageously on newly opened up or newly cleared tea land and considerable profits would be forthcoming before the tea comes into yielding and by growing indigo between the bushes, the soil would be enriched with nitrogen. In addition experience in Bihar has shown that " seet " is an admirable manure for sugar cane and hence the distinct advantage of growing indigo on newly opened up sugar cane estates.

The growth of flax with indigo should also be considered at the present time ; flax could be grown and manufactured in the cold weather and the indigo vats would be very suitable for the retting process, and this crop would advantageously utilise labour in the off-season. A large supply of seed could also be obtained which could be pressed for oil and cake to be utilised as manure.



II. — NATURE OF THE CHANGES THAT TAKE PLACE DURING THE EXTRACTION OF THE INDIGO. — The facts presented in this paper indicate clearly the general nature of the changes occurring in steeping and beating to extract indigo, and the development of harmful acidity which is apparently one of the principal causes of low produce and impurity. Suggestions are made with a view to general improvement from a practical working standpoint as regards:

1) The selection of favourable non-destructive types of bacteria in steeping; 2) the study of methods of establishing these in the steeping vat; 3) methods to obviate the destructive action during steeping and beating on the indoxyl of acidity developed by bacterial action.

In all the experiments referred to, whether carried out on laboratory scale or on a larger scale in the experimental vats at Pusa, a known weight of plants was taken and steeped in a known volume of water, the percentage of leaf on the plants and the percentage of indican in the leaf being previously determined. In this way the possible yield of indigotin could be calculated. Analyses were made with a view to following the progress of extraction and hydrolysis.

Typical bacterial fermentations of the indigo plant are described which show that although wide variations may occur in the efficiency of extraction and efficiency of oxidation, the general principles of the action are quite definite. Results obtained in these experiments illustrate the necessity for having a simple test to decide each day the exact time of steeping required (See Pt. I). Tables, figures and graphs, show the results obtained after fermentation with various types of water and also with distilled water. The rate of formation of acid in steeping (*i. e.* carbonic acid) varies widely in different fermentations and this has a very marked effect on the yield and purity of the resulting indigo. The necessity for control and the test recommended have been described above (Pt. I) and it is equally important to prevent the development of too high an acidity in steeping.

102 - **Changes in the Composition of Sheep's Milk during the Lactation Period; Experiments Made in Hungary.** — WEISER, ST. (Communicated by the Experiment Station of Animal Physiology at Budapest), in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. VIII, Parts 1-2, pp. 131-140, 3 tables. Berlin, November 1920.

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Experiments on two Frisian ewes kept at grass during the lactation period lasting from the middle of March to the middle of September. The animals were milked twice a day and samples of the milk were taken every month. The morning and evening milk was not mixed. The data obtained refer to the average values of the combined morning and the evening milks respectively of the two sheep. By calculating the average composition of ewe's milk during one period of lactation and comparing the values obtained with the figures given by other authors, it can be seen that these values only vary within very narrow limits, as is shown by the following Table.

*Average Composition of Ewe's milk during One Lactation Period  
as Estimated by Different Authors.*

Authors	Specific gravity	Dry matter	Fat	Total protein	Casein	Albumen + globuline	Lactose	Ash
	%	%	%	%	%	%	%	%
KÖNIG . . . . .	1.0355	16.43	6.18	5.15	4.17	0.98	4.17	0.93
FLEISCHMANN . . . . .	—	17.00	5.30	6.30	4.60	1.70	4.60	0.80
FLEISCHMANN (advanced lactation) . . . . .	—	24.60	11.77	8.12	6.48	1.64	3.65	1.06
BAINTNER F. (Transylvanian Zackel breed) . . . . .	1.0382	16.53	5.21	5.72	—	—	4.87	0.83
BIRÓ G. (hybrids Zigaya × Frisian and Zackel × Frisian) . . . . .	1.0370	19.07	7.45	—	—	—	—	0.79
WEISER St. . . . .	1.0372	17.10	6.24	5.44	4.52	0.92	4.29	0.85

The effect of the course of the lactation period upon ewe's milk has been studied by several authors. The most thorough investigations have been made by O. LAXA (1) and F. BAINTENER (2). In the author's experiments the sheep's milk underwent considerable changes during the lactation period.

The amount of dry matter perceptibly increased for the two first months (March and April), then remained about the same till August, after which it again increased. Between March and September the total increase was 7 %. LAXA made the same observations in the course of his experiments with the Orava breed of sheep. He found the dry matter content of their milk to be from 14.92 % to 17.35 % in April and 24.6 % in October.

In other experiments, with the Zackel breed of sheep the dry matter rose to 14.10 — 15.26 % in April and to 25.94 % in October.

In BAINTENER's experiment with Hungarian Zackel sheep the dry matter content reached 13.7 % in March and 20.23 % in September.

As regards fat, similar observations were made.

The fat content rose for the first 2 months, remained about the same for 4 months and then again increased a little in the last month.

The total increase in fat was 4.35 % (from 3.5 to 7.85 %). In BAINTENER's experiments, the average fat content of sheep's milk was 2.92 % in April and 8.14 % in September.

LAXA found that the fat content of the milk rose during 7 months from 4.27-6.25 % to 9.67 % and from 4.44-5.0 % to 9.65 %. On the other hand the changes in the dry matter and the fat content recorded by G. BIRÓ were less than those reported by the author, LAXA and BAINTENER.

(1) Cf BURR, A. and BERBERICH, F. W., Studien über Schaf-Milchwirtschaft, 1911, pp. 30-35.

(2) *Ibidem* p 31. (Author's note)

From April to August the dry matter increased from 17.57 to 20.63 and the fat content from 6.34 to 9.02 %.

The casein content varied differently from the albumen and globulin contents, for whereas the quantity of casein remained fairly constant from April to August, only rising a little during the latter month, the changes in the albumen and globulin were greater though more irregular.

The amount of lactose decreased 1.41 % as the lactation period advanced, falling from 4.83 to 3.69 %. In BAINTRER'S experiments it fell to 1.13 %.

The percentage of mineral substances also underwent changes during the lactation period, rising to 0.72, in March and to 0.97 in September.

An even more marked advance of the lactation period was shown in the composition of the dry matter of the milk. The fat content of the dry matter increased greatly after the first month, and then remained about the same until the end. The amount of fat-free extract changed but little after the first 2 months. The lactose content of the dry matter however decreased perceptibly during lactation. A slight drop was also noticed in the ash of the dry matter (5.55 % in March ; 4.57 % in September).

The crude protein of the dry matter increased slowly, but continuously : 24.52 % in March ; 29.70 % in September. The changes which took place in the amount of casein in the dry matter, were similar in character, although less in degree, to those observed in the fat content (24.52 % in March, 26.60 % in April and respectively 23.93 — 24.85 — 26.91 — 27.63 — 29.70 % in May, June, July, August and September). The albumen and globulin were found to increase more than the casein (2.62 % in March. 6.23 % in September), while the amount of anides slowly diminished.

On comparing the changes taking place in the milk composition during the lactation period (1) it is found that they are much greater for sheep than for cows.

103 - **Live Stock Industry in Fiji.** — See No 82 of this *Review*.

104 - **The Turkey Industry in Sologne, France.** — See No 88 of this *Review*

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(1) See: KFFLNER, O., *Die Ernährung der Landw. Nutztiere*, 6th Ed., p. 518, and also TANGEL and ZATSCHECK, in *Die Landw. Versuchs-Stationen*, Vol. LXXIV, p 233. Berlin 1911. (*Author's Note*) — See also: R. April 1913, No. 391. (*Ed.*)

## PLANT DISEASES

### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN

105 - **A Transmissible Mosaic Disease of Lettuce in the United States, especially in Florida.** — JAGGER, I. C., in *Journal of Agricultural Research*, Vol. XX, No. 10, pp. 737-740, pl. 1. Washington, D. C., Feb. 1921

In January 1920, Roman lettuce (variety Paris White Cos) in a field at Sanford (Florida) was noticed to be attacked by a transmissible mosaic disease, showing a yellowish discoloration along the smaller veins of the younger expanding leaves. This symptom was usually evident for a few days only, followed by a general yellowish appearance of the whole plant. All gradations of discoloration occurred, from very marked, to conditions hardly to be distinguished from the normal. Close examination usually revealed irregular blotches of a comparatively normal green colour, generally located along the larger leaf veins. The blotching varied from a few green patches barely perceptible on a yellowish leaf to numerous pronounced green spots giving a marked mottled appearance to occasional plants. The leaves of diseased plants generally seemed to be rather more wrinkled than those of normal plants. Where plants became diseased only after reaching a considerable size, the older leaves, which were fully expanded on the first appearance of the symptoms, frequently continued to appear perfectly normal, while all the younger leaves developed disease symptoms. At the same time the head lettuce (variety Big Boston) in a neighbouring field, developed a similar diseased condition. The general yellowish appearance of whole plants was frequently pronounced, but in most cases the blotching was less marked than in the Roman lettuce, and a decided mottled appearance was never observed.

In general, diseased plants were stunted. In severe cases the plants were decidedly undersized, and occasionally the leaves formed only a rosette. Usually loose heads of poor quality were formed, although all gradations of development, including occasional heads of normal size and hardness occurred. Often plants that showed marked discoloration, mottling and stunting soon after becoming diseased, seemed partially to recover later and to make a more or less normal growth with only slight discoloration and mottling.

106 - **Dry Gummosis of Citrus Trees in Sicily.** -- SAVASTANO, L., in *R. Stazione sperimentale di Agrumicoltura e Frutticoltura, Agrale, Bollettino* 41, pp. 5-7. Aci-reale, 1921.

The extraordinary drought which prevailed in Sicily in 1920, accentuated a type of gummosis which is little noticeable in normal years. This form of the disease has been called by the author "gommosi secca" (dry gummosis). It consists of a diseased condition appearing on the branches and trunks of the citrus trees, but not accompanied by any flow of gum from the cortex, being thus confined to the cambium and sap-wood. The disease spreads chiefly along the branches and trunk in a longitudinal direction. The tissues, when attacked, first become dark coloured sometimes turning almost livid. The characteristic symptom distinguishing this form of the disease from ordinary gummosis is the dryness of the affected zone. During the first period of the attack, the cortex remains green and intact, giving no hint of the existence or spread of the disease. Soon, however, it begins to wither and assumes the characteristic aspect of bark infected by this form of gummosis, becoming dry, wrinkled and somewhat darker in colour.

Dry gummosis has a greater pathological effect upon the growth of the diseased branch or trunk than the usual moist form. The ascent of the sap being interrupted, the branches and twigs begin to wither in the region of the patch of gummosis; the process first affecting the delicate growing tissue of the extremities. If the base of an otherwise healthy branch is wholly surrounded by diseased tissue, the branch slowly perishes; if the infected tissue only partially encircles it, the disease spreads from the infected part upwards, the branch withering during its progress, according to the severity of the attack.

Dry gummosis and moist gummosis may occur alternately in successive years.

In the spring of 1921, many cases of dry gummosis were observed in gardens of citrus-trees in the district of Messina, where cultivation methods have been radically changed for many years past in order to obtain "verdelli" (green lemons). The usual irrigations in these cases are suppressed from May to July; this treatment, known as "la secca," was followed in 1921 by a drought that greatly increased the severity of the disease. Liberal irrigation subsequent to "la secca," which forms part of the technique of the cultivation of "verdelli," only increased the evil by augmenting the water pressure in the interior of the tree.

An examination of several citrus gardens showed that dry gummosis is as old a disease as ordinary gummosis, but that on account of the exceptional drought in 1921, it had assumed a very severe form and thus attracted attention.

The best means of controlling this disease is systematic pruning and manuring, more ploughing and less irrigation; in short, the citrus-tree grower must adopt all the methods of treatment and of hygiene that have hitherto proved successful in the case of ordinary gummosis.

# DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

## GENERAL

107 - **Fungi of Macedonia.** — SYDOW H., in *Annales Mycologici*, Vol. XIX, Nos. 3-4, pp. 243-254. Berlin, 1921.

A list of the fungi collected by Prof. J. BORNMÜLLER in North and Central Macedonia in 1917 and 1918, and determined by the author.

As little is known about the Macedonian mycological flora in general, and the micromycetes in particular, most of the species mentioned may be regarded as new for the part of the country visited.

The following fungi are new to science: *Uromyces Hippocrepidis* Syd., living on *Hippocrepis ciliata*; *Puccinia lolii* Syd., on *Lolium perenne*, and *Aecidium macedonicum* Syd., on *Phyteuma limonifolium*.

Among the other species found, special mention should be made of *Ur. valesiacus* Ed. Fisch. which had hitherto only been known in Switzerland, but has now been observed on the same host-plant (*Vicia onobrychioides*) in Macedonia, not far from the frontier of Albania.

108 - **New Studies on the Life-History of "Malvacea Rust" (*Puccinia Malvacearum*).** — ERIKSSON, J., in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, 1921, 2nd Half-Year, Vol. CLXIII, No. 20 (Nov. 18, 1921), pp. 925-928.

In the present article, the author summarises the results of the researches he has been making for the last ten years on the life-history of "Malvacea rust" (*Puccinia Malvacearum* Mont).

A). Germination of spores. — His latest studies have shown that this fungus has two forms of spores which although similar morphologically, are very different from the biological standpoint.

In Sweden one of these forms appeared late in the season (Sept.-Oct.) on young plants of the hollyhock (*Althaea rosea*), sprung from seed sown in the summer (June), and also during the following autumn (August-October), on plants that had over-wintered, but only in the case of hollyhocks belonging to an infected line. To this form the author gave the name of "autumn spores".

The other form appeared some years in spring and summer (May-June), on plants that had survived the winter; the spores manifested themselves generally after an interval of three or four weeks. These are the "summer spores".

The "autumn spores" can germinate in two ways. If they find themselves immersed in water, for instance at the bottom of a drop of water, they send out long filaments which are at first slender and straight, but afterwards become bent at the extremity. The terminal, very short segments separate like conidia. If on the other hand, the spores are on the surface of a drop of water, or exposed to air saturated with water-vapour, they emit short, wide promycelia, curved like a bow and producing sporidia.

The "summer spores", however, always germinate in the same manner, and form long filaments bearing conidia.







Some of the results of experiments on the germination of the two forms of spores are given in Tables I and II.

TABLE I. — *Germination of Autumn Spores.*

Paris, 1921.

s = short filaments (with sporidia)

l = long filaments (with conidia)

*Althaea rosea* (from Oct. 1 to Oct. 15, 1914).

Day of observation	Number of Spore Pustules			Germination
	On water-drops	Immersed in water	In air saturated with watervapour	
October 1 . . . . .	5	"	"	c
" 2 . . . . .	6	"	"	c + l
" 3 . . . . .	0	"	"	c
" 3 . . . . .	"	"	"	l
" 9 . . . . .	"	"	4	c
" 11 . . . . .	"	"	4	c
" 12 . . . . .	"	10	"	l
" 15 . . . . .	"	"	8	c + l
" 15 . . . . .	"	6	"	l + c

TABLE II. — *Germination of Summer Spores.*

*Althaea rosea* (from 7 June 23 to July 29, 1920).

Day of Observation	Spore-bearing organ	Spores germinating in water	
		Exposed	Under a thin slip
June 23 . . . . .	old leaf	1	1
" 27 . . . . .	young	1	1?
" 27 . . . . .	old	1	
July 3 . . . . .	intermediate	1	1
" 4 . . . . .	young	1	1
" 15 . . . . .	intermediate	1	1
" 29 . . . . .	young leaf	1	1

B). *Diseased and Healthy Lines of Althaea rosea.* — In addition to the diseased lines of hollyhock, there are also others that remain healthy throughout the growth period, as is shown by Table III on the following page.

In studying this table it will be seen that a healthy line can become infected if the plants are near diseased individuals at the time of the pro-

TABLE III — *Healthy and Diseased Lines of Hollyhock grown near Stockholm from 1912 to 1920.*  
Bergianum = Hortus Bergianus (Botanic Garden at Bergen).

year	Place of origin	1st year Outbreak of Late Season	2nd year (flowering season)			Line	
			Period of exemption	1st period of Disease (summer stage)	2nd period of Disease (autumn stage)	at the beginning	at the end
1912	Haga (Stockholm).	serious 15/8-15/9	3/5-18/6	serious 26/6-15/7	serious 31/7-17/8	diseased	diseased
1913	Haga	serious 1/9-30/10	2/5-24/3	serious 24/5-4/7	serious 25/7-23/8	diseased	diseased
	Bergianum	o	3/6-25/7	o	serious 28/7-22/8	healthy	diseased
1914	Haga	serious	o	serious 1/5-25/7	serious 27/7-	diseased	diseased
	Bergianum	o	2/5-8/5	serious 1/5-25/7	serious 27/7-	healthy	diseased
1915	Hilleskog (Landskrona)	slight 3/10-10/11	20/5-10/7	o	serious 16/7-6/9	diseased	diseased
	Haga	very slight 13/10-3/11	20/5-10/7	o	serious 16/7-6/9	diseased	diseased
1916	Bergianum	very serious 3/9-3/10	series A. 17/5-12/7	o	serious 19/7-9/8	diseased	diseased
	Bergianum	very serious 3/9-3/10	series B-D. o	slight 17/5-12/7	serious 19/7-9/8	diseased	diseased
1917	Bergianum	? very serious	24/5-23/8	o	o	healthy	healthy
1918	Bergianum	2/11	6/5-20/8	o	o	diseased	healthy
1919	Västerås	? very slight	23/5-15/9	o	slight 4/8-15/9	? diseased	diseased
	Haga	very slight	19/5-15/9	o	serious 4/8-15/9	diseased	diseased
1920	Bergianum	o	19/3-15/9	o	o	healthy	healthy
	Bergianum	very serious 21/9-18/10	15/5-23/8	o	o	diseased	healthy
1920	Västerås	o (?)	15/5-23/8	o	o	healthy	healthy
	Haga	o (?)	15/5-23/8	o	o	healthy	healthy

duction of the "summer spores" (for instance, in 1913 and 1914). Similarly a diseased line can regain its health if the vital energy of the fungus becomes exhausted (as in 1918 and 1920).

109 — **On the Germination of the Zoospores of Vine "Mildew".** — RAVAZ, J., and VERGÉ, G., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, 1921, 2nd Half-year, Vol. CLXXV, No. 25 (Dec. 19, 1921), pp. 1421-1423, Paris, 1921.

The emission and germination of the summer zoospores of *Plasmopara viticola* depend upon very limited conditions of environment.

All natural waters are not equally suited to these processes; no zoospores are ever formed in the drainage water or the water from a certain well in the neighbourhood of Montpellier. The author found no appreciable traces of copper in this water, although it came from vineyards that had been liberally treated with copper sulphate. Spring-water from a district of the Allier, where no vines are cultivated, proved equally unfavourable to the formation of zoospores, and there were irregular germinations only in water distilled in glass, or in the water of the town of Montpellier, through coming from land which is not under vines.

The inhibiting properties of the water cannot be adequately explained by differences in electric conductivity, but they can be modified by the addition of small quantities of various substances. If sulphuric acid, carbon dioxide and even a very small amount of sulphate of copper is put into the water, it frequently happens that the zoospores present will germinate.

On the other hand, germination takes place regularly in rain-water or dew, and also in twice distilled water.

The authors used rain-water in their studies of the sterilising effect exerted by various toxic substances on the zoospores of vine-mildew which were thus as far as possible under natural conditions.

All the cultures were grown in watch-glasses containing from 0.5 cc. to 1 cc. of the toxic solution and kept under a bell-glass in an atmosphere saturated with water vapour, at hot house temperature.

Each series of experiments included control cultures grown in water alone.

The results obtained from spores of the same age and in similar condition were at first somewhat incomprehensible, germination taking place in concentrated toxic solutions, and failing to do so in weaker solutions. The causes of these divergences appear to be: 1) the volume of the solution and its surface tension which only allowed the conidia (zoosporangia) to be partly immersed, or in other words, germination depends on the solution reaching the whole surface of the conidia; 2) the number of spores in each culture.

There is no doubt, that the great variations observed in the toxicity of the same substance are due to similar differences in the composition of the solutions and to the method of sowing the spores.

It was found from the experiments (over 600 in number) that germination was arrested by a  $\frac{1}{5000}$  solution of sulphuric acid in rain-water and

by copper sulphate solutions varying from  $\frac{1}{300\,000}$  to  $\frac{1}{400\,000}$ , which correspond on an average to  $\frac{1}{1\,000\,000}$  of metallic copper; a saturated solution of sulphate of lime does not prevent germination, and carbonate of sodium is only active in solutions of  $\frac{1}{8000}$  —  $\frac{1}{7000}$ .

In the case of sodium and calcium certain precautions have to be taken. Cultures kept under a moist bell-jar without any carbon dioxide remain sterile up to  $\frac{1}{70\,000}$  —  $\frac{1}{80\,000}$  in the case of the calcium solution, and up to  $\frac{1}{20\,000}$  in that of the sodium.

In ordinary air however the calcium and sodium solutions quickly lose their toxic power through the action of the carbon dioxide; this in the case of the former is shown after less than an hour's exposure, the surface of the calcium being covered with crystals of calcium carbonate.

If a 6 % lime mixture is sprayed on the leaves of a vine-stock kept for one night under a moist bell-jar there is no reaction to phtalein next day. A similar stock treated with the same lime solution immediately turns a brilliant red in the presence of the reagent; but loses its colour by the following day if the night is damp, though the litmus paper re-assumes a slight bluish tint, but as it changes with Ph. 7.07, this may indicate the end of acidity quite as well as the beginning of alkalinity.

Only a very short time, occasionally even less than a night, is necessary to neutralise perceptibly the lime in cupric mixtures. This explains their failure, if lime is the only active principle.

It is agreed that atmospheric precipitations can only dissolve extremely small quantities of copper which are quite insufficient to hinder the germination of the spores of *Pl. viticola*.

If however dew taken from the surface of leaves that have been sprayed with a slightly alkaline cupric mixture is examined, very large quantities of copper, equivalent to  $\frac{1}{10\,000}$  or  $\frac{1}{7000}$  of copper sulphate, will be found present in the clear portion. Rain water, which washes the leaves as it falls, contains according to the rapidity of its descent from  $\frac{1}{50\,000}$  to  $\frac{1}{10\,000}$  parts of copper sulphate.

In such water, no germination takes place, not only immediately after the application of the cupric mixture, but even when 1, 2, 7, 9, 10, 11, 14, 15, 16, 20 days have elapsed, and after successive precipitations of 19 mm., 4.53 mm., 1.0 mm., 0.5 mm (dew), 19 mm., 1.11 mm. 2.0 mm., 0.4 mm. (dew), 41 mm., 4.92 mm., 8 mm., 1.8 mm., 0.2 mm (dew). This further shows how well cupric-calcic sprays adhere to the leaves. It required torrential rains of 41.4 mm. and 92.8 mm. to remove the

greater part of the copper, and the small quantity left was sufficient to render the dew sterile.

To sum up: calcium is too soon affected by the carbon dioxide of the air (with the formation of calcium carbonate), to be practically effective. Cupro-calcic mixtures resist for a prolonged period the action of rain and dew, but enough copper is in most cases washed off to make the water an unsuitable medium for the germination of the zoospores of the "mildew".

110 — **Kanota Oat Var. Resistant to Rust and Smut in Kansas, U. S.** — See No 35 of this Review.

RESISTANT  
PLANTS

111 — **"Formosa", Spanish Vine not Attacked by "Mildew" in Italy.** — DIANCINI, C., in *Giornale viticolo italiano*, Year XLVII, No 49, p 488. Casale-Monferrato, December 1, 1921.

At Ceccano in the Province of Rome, the Spanish vine "Formosa", which bears excellent table-grapes, proved so resistant to mildew in 1921, a year when this disease was exceptionally severe, that it may almost be regarded as immune. In fact where it has been left untreated, as a control among a number of other varieties, the Formosa has not been touched by "mildew" and has remained green and luxuriant.

112 — **Copper, the Active Principle in Sprays.** — FENZES-DIACON, in *Le Pro grès Agricole et Viticole*, Year XXXVIII, No 52, pp. 611-612. Montpellier, December 25, 1921

MEANS  
OF  
CONTROL

VILLEDEU believed that his laboratory experiments with basic copper mixtures furnished sufficient proof of the non-toxic action of the copper, and therefore concluded that the anticryptogamic effect of these compounds must be due solely to the basic character of the medium.

He therefore advised that the usual mixtures should be replaced by a compound containing a large amount of lime, and hence very basic, in which the secondary part of fixative on the vine shoots should not be sulphate of copper, an expensive foreign product, but sulphate of aluminium which can easily be supplied at lower cost by French industry.

VILLEDEU now fully recognises the complete failure of his formula which was tested by experiments carried out in vineyards in various districts of France, but in his recent communication to the Académie des Sciences he is still of opinion that the efficacy of alkaline cupric mixtures in the control of "mildew" is to be attributed to their basic character, and not to the action of the copper compounds.

The author considered that the toxic effect of the copper in these sprays was clearly demonstrated by MANCEAU'S comparative experiments with alkaline Bordeaux mixture and VILLEDEU'S mixture. From these trials made in the open vineyard, MANCEAU draws the following conclusions. "Although the 1921 outbreak of "mildew" was not severe, VILLEDEU'S mixture proved of little use but the application of Bordeaux mixture kept the leaves healthy and insured a vigorous growth."

A convincing proof was obtained in the course of these experiments by adding 100 gm. of copper sulphate to a VILLEDEU mixture containing 5

kg. of lime, for the anticryptogamic action of the compound was found to persist throughout the whole vegetative period.

It is necessary, in order to realise the full significance of this experiment, to explain that the addition of so small a proportion of copper sulphate in no way altered the basic character of the mixture.

In fact, a little of the excess lime went to form a sulphate, thus setting free an equivalent amount of copper hydrate of the same basicity, and yet although the caustic property of the mixture was lessened, since copper hydrate is much less soluble than lime, it was still efficacious against "mildew."

Thus, by the addition of a little copper sulphate, which was not sufficient to alter the basic character of the mixture, the vanished anticryptogamic action re-appeared; is it due to the basic function that has not been changed, or to the copper? The author thinks there remains no shadow of doubt that copper compounds actually possess the efficacy against "mildew" that has been attributed to them as a result of long practical experience.

113 - **Experiments in the Use of Salts of Mercury in the Anticryptogamic Treatment of Seeds.** — GABIT, W., in *Zeitschrift für anorganische Chemie*, Vol XXXIV, No 91 pp 567-588 Leipzig, November 25, 1921

In the anticryptogamic treatment of seeds, use has hitherto been made either of the mineral salts of mercury (usually corrosive sublimate), or of complex organic mercurial compounds. Whereas in the presence of sodium or of ammonium sulphide, the mineral salts liberate mercury, the complex organic mercurial compounds are not acted upon at all, or else only to a very slight extent by these two salts, they also differ from bichloride of mercury in giving no precipitate with albuminoids so that they have no corrosive effect upon the seed, nor do they hinder its growth, while according to some accounts, they seem to have a good effect upon the yield.

The simplest organic compound of mercury is the cyanide; it is more efficacious in conferring immunity than the more complex compounds. By its use, the development of *Helminthosporium graminum* (1) can be prevented, a result never attained with the sublimate. The mineral salts of mercury, especially the sublimate, were introduced into practical agriculture by HILTNER in 1906, and used combined with copper sulphate under the name of "fusariol" for the treatment of seeds. HILTNER and his fellow-workers also tried to use various other mineral preparations of mercury. The employment of complex mercuric salts is of more recent date; they were first introduced in 1913 by RICHEM, while REMY adopted chlorophenolate of mercury for cereals attacked by *Fusarium* spp; this compound is the essential ingredient in "Uspulun." Another complex organic mercurial salt, cyanomercuricresolate of sodium, is present in "germisan", a very active but slightly poisonous anticryptogamic

(1) See R Dec 1921 No 1295. (1 d)

remedy; another substance employed in treating seeds is called "fusafine". It contains 20 % of corrosive sublimate, kitchen salt, sodium sulphate, and an azoic colouring matter.

- 114 - ***Aspergillus varians*, a Mucedinea Parasitic on Maize, in Italy.** — CIPERRI, R., in *Rivista di Patologia vegetale*, Year XI, Nos. 7-8, pp. 89-93. Pavia, October 29, 1921.

DISEASES  
OF VARIOUS  
CROPS

The author records the clearly parasitic behaviour of *Aspergillus varians* Wehm — hitherto only known as a saprophyte -- which was found frequently, in 1921, on the caryopsids of maize at Petriolo (Prov. of Macerata). All or nearly all the infected ears came from plants cultivated on the low-lying, damp, foggy fields situated along the course of the Cremona, where owing to the situation of the cultivated slopes and the thick shade made by the willows and poplars growing in abundance on the banks of the stream, there is very little sunshine.

The maize-plants were poorly developed, having small imperfect heads that ripened late and remained always damp even when ripe. The fungus confined its attacks almost exclusively to the seeds at the top of the cob which as being the least protected by the bracts are the most exposed to parasitic attack. These caryopses are always attacked in the part that is free from the rachis, they are much smaller and softer than the others, become discoloured, and ripen later than the healthy caryopses on the same head. The seeds of plants grown in dry high places were never infected by *Aspergillus varians* unless other causes, such as cracks exposing the starchy contents, facilitated its attack.

Another Mucedinea, *Cephalosporium Acremonium* Corda, has been found parasitic on *A. varians*.

- 115 - ***Macrophoma flaccida*, a Deuteromycete Causing Deterioration in Dried Grapes in the Marches, Italy.** — CIPERRI, R., in *Rivista di Ampelografia*, Year II, No. 11, pp. 164-166. Leghorn, November 1, 1921.

In the Province of Macerata, and in nearly all the Marches, it is the custom to keep fresh grapes for domestic consumption. The ripe grapes used for the purpose are gathered at the time of the vintage and the bunches are hung on reeds suspended from the ceiling of a cool, well-ventilated room, a cellar on the ground-floor being generally chosen. The grapes thus treated keep well until after New Year's Day. Those chosen for keeping are always white, such as "Verdicchio," although occasionally French Muscat and "Zibibbo" are used. Under normal conditions, grapes kept in this way shrivel and assume a colour varying from amber to brownish yellow, having in short all the characters of dried grapes.

In 1921, the berries taken from a considerable quantity of dried "Verdicchio" were of a violet brown colour, shrunk and soft; their surfaces were covered with small blackish pustules with a white spot in the centre emerging from a brownish-yellow patch of limited extent.

Microscopic examination revealed the presence of fungus fructifications (pycnidia and spermogonia) belonging to the agent of the alteration identified as *Macrophoma flaccida* (Viala and Ravaz) Cav., a deuteromycete

hitherto found only on grapes left hanging on the vines after the vintage, and hence regarded as of little practical importance.

On all the bunches in the vineyard where the grapes had been gathered, dark-red berries had often been observed which were probably attacked by the form of "mildew" known as "brown rot." Two different kinds of mycelium were, however, found on the grapes examined, one of which the author attributes to a "mildew," and the other to *Macrophoma flaccida*.

A careful inspection of the "Verdicchio" grapes at the place where they were dried showed that nearly all the berries of the suspended bunches were infected. The distribution of the diseased grapes in each bunch appears to be due to chance; the rest of the berries were pale-green, or golden-yellow, and therefore obviously free from "brown-rot."

As regards the deterioration from the agricultural standpoint, little serious damage is to be feared from the deuteromycete which behaves as a saprophyte. It is however self-evident that for grapes to keep well, they must be immune from all disease, and in the case in question, from "mildew". Therefore the control of *Macroph. flaccida* resolves itself into the control of the "mildew".

116 - On the Cankorous Tumours of *Diplodina Castaneae* Observed on the Chestnut-Tree in France. — DUFRENOY, J., in *Comptes rendus hebdomadaires de la Société de Biologie*, Vol. LXXXV, No. 36, pp. 1059-1061, 3, figs. Paris, 1921.

When a plant is attacked by a parasite, the manner, degree and results of its reaction depend essentially upon the time that the pathogenic agent and its host are able to co-exist.

This fact is clearly shown in the case of chestnut trees attacked by *Diplodina Castaneae* ("Javart"). The parasite kills the cambium cells, causes hypertrophy and hyperplasia in the active cambium some little distance off, and induces many thyloses in the vessels of the deep-seated wood.

If the victims are young chestnut poles, necrosis invades the cambium of the wound-callus forming round the first seat of infection, the disease spreads faster than the callus grows, and death rapidly ensues owing to the destruction of the ring of cambium.

On a tree trunk cicatrization proceeds more quickly than the destruction of the cambium, leading to the formation of great pads of tissue formed of overlapping scales. All that is required for the continued growth of the canker is that a certain number of the cambium cells should be protected by the suberised layers continually being formed in the phelloderm. This very sinuous barrier describes curves around the pericycle fibres which become delignified, while the more or less swollen membranes in the neighbouring parenchyma fix the lignin.

117 - A Wide-Spread Attack of *Rhytisma acerinum* Observed on the Leaves of the Common Maple in the Marches, Italy. — CIFERRI, R., in *Rivista di Patologia vegetale*, Year XI, Nos. 7-8, pp. 93-95. Pavia, October 29, 1921.

It has been noticed of late years, in the Province of Macerata, that the leaves of the Common Maple (*Acer campestre*) — grown in rows in the



fields to serve as supports for vines — fall prematurely, a few being shed at first, and a larger quantity a little later. Further a certain number of maple-trees wither and finally die. Much injury is thereby caused to the vines, as the soil is disturbed by the up rooting of the dead tree and the planting of a new one. The maples that survive become completely defoliated. The leaves, although not of much value are still useful to the agriculturist especially in seasons when forage is scanty and they are the sole product of these trees.

As a result of a visit to one of the places where the disease was most prevalent, viz. the low-lying, damp, foggy ground along the bank of the Cremona, it was found, that the leaves of *A. campestre* were attacked by the pycnidial form (*Melasmia acerina* Lév.) of *Rhytisma acerinum* (Pers.) Fr.

The disease caused by this fungus known as "Croste nere delle foglie dell'acero," which is usually of little or no importance in Italy, had broken out in the form of an actual epidemic in the district visited.

The severity and wide-spread character of the attack was not only due to the fact that the fallen leaves were not collected and burnt — the only way of destroying the fungus, for anticryptogamic mixtures have no effect upon it — but also to the continual damp of the environment.

In the same zone were observed, *Rhyt. punctatum* (Pers.) Fr., also on the maple, but more rarely, and *Rhyt. salicinum* (Pers) Fr., under its pycnidial form (*Mel salicina* Tul.) on the leaves of *Salix viminalis*. Willows growing in dry places were not attacked by the last fungus.

118 — ***Cenangium piniphilum* n. sp. Discomycete Injurious to *Pinus ponderosa* and *P. contorta*, in the States of Idaho, Washington and Montana.** —

WEIR, J. R., in *Phytopathology*, Vol. XI, No 7, pp. 294-296, figs 2, pl. 1 Lancaster, Pa., 1921.

A new species of Discomycete designated by the name of *Cenangium piniphilum* was first collected at Boulder (Montana) on *Pinus contorta* on June 8, 1915. Since then it has been found in abundance in the lake region of northern Idaho, where it attacks *P. ponderosa* and *P. contorta*. This type has been collected on a 15-year old tree of *P. contorta* at Priest River (Idaho) in the Kaniksu National Forest on May 12, 1920. The species is common throughout northern Idaho, eastern Washington and western Montana.

This fungus, which is of considerable forestal importance, attacks *P. ponderosa* and *P. contorta* between the ages of 5 to 25 years or more. Infection usually occurs at the nodes, less frequently on the internodes, but may eventually spread throughout the entire length of the stem. The mycelium penetrates the cortex, phloem and wood and causes canker. The cambium is killed, preventing any further growth in the thickness at the point of infection, and with each year's increment the outline of the tree in cross section becomes more irregular. The penetration of the mycelium into the cortex, phloem and wood causes the exudation of large quantities of resin on the surface of the canker which runs down the bark very conspicuously. The dark brown much-branched mycelium follows

chiefly the medullary rays in the wood and gives it a greyish or bluish-black colour which resembles *Ceratostomella pilifera* (Fr.) Wint. This colour may extend to varying depths or entirely through the trees in the case of two oppositely arranged cankers. The colour which always indicates the presence of mycelium may extend from one canker to another up and down the tree and is very conspicuous in longitudinal section. Brownish-black deposits in the various cells especially in the resin channels and medullary rays intensify the colour. The mycelium develops both in the cells and in the intercellular spaces. The apothecia are formed on the dead bark of the canker and vary in size according to the age of infection. The fact that infection usually occurs at the branch whorls, indicates a natural weakness at this point, and should not be attributed to wounds. Wounds caused by various agents are however a source of infection, and this has been demonstrated by experiments. The transfer of spores to incisions in the bark of young trees has always given rise to infections. When these occur at the base of the branches, they spread to the main trunk, frequently involving the entire circumference at this point. The number of cankers on a single tree is in some cases limited only by the number of whorls. A 15-year old tree may have as much as ten or more separate and distinct cankers. All these cankers may be united internally by discoloured wood. A thin ridge of tissue winding from one canker to another may be the only part which remains intact.

Although the fungus grows readily in artificial media, it has not yet been induced to form apothecia. The mycelium on artificial media breaks up into conidia, a condition not observed in nature.

The fungus thrives best in dense, moist stands.

119 - **The White Pine Blister Rust (*Cronartium ribicola*) found in Pennsylvania** (1). — *Weekly News Letter*, Vol IX, No. 15, p. 4. Washington, Nov. 9, 1921.

For the first time since the white pine blister rust aecidial form *Pedidermium Strobi* Kleb. was discovered in America, currant and gooseberry bushes were found to be attacked in Pennsylvania (Wayne Co.) in the autumn of 1921.

Although some blister rust has been noticed on pines in Pennsylvania these plants had been brought from Europe in diseased condition and were destroyed immediately.

120 - ***Trametes Pini* in Old Stands in the Joux Valley, Switzerland.** — PILlichODY, A., in *Journal forestier suisse*, Year LXXII, No. 12, pp. 223-226. Berne, Dec. 1912

*Trametes Pini* is a much less well-known parasite of pine-trees than *Tr. radiciperda* (= *Fomes annosus*), for it occurs more rarely and as it were accidentally, whereas *Tr. radiciperda* is nearly always present in plantations whether on the plain or the mountain especially where the soil is heavy. This fungus attacks by preference young stands, whereas the "red rot" (*Tr. Pini*) is a disease of adult trees. Infection takes place

(1) See R Nov. 1921, No. 1193 (Ed.)

through wounds in the trunk and especially through broken branches. Quite young trees are protected by a copious flow of resin, but this becomes less as the pine grows older, so that the fungus mycelium is able to penetrate into the interior of the trunk.

*Tr. Pini* develops chiefly in the central portion of the trunk and destroys the wood that has reached a certain age and is no longer full of resin. The disease which usually starts from a rotten branch advances both centrifugally (from the centre to the periphery) stopping when it reaches the young layers of wood which are still impregnated with resin, and ascending and descending vertically. Thus the middle of the trunk is the part chiefly attacked. It frequently happens, that a tree is quite sound at the level at which it is felled and also at the top, while the intermediate portion is so much decayed that nothing remains but the bark and a thin layer formed of some of the annual rings which insure the circulation of the sap.

As a rule, the presence of the disease is revealed by the appearance of the fungus fructifications in the form of largish brown brackets developing along the trunk usually at the place formerly occupied by a broken branch through which the disease had gained entrance. These brackets only appear when the malady is already far advanced.

Sometimes in place of the bracket, yellowish-brown crusts form that seem to creep up the lower surface of certain withered branches and thus betray the presence of the disease, being easily visible in a good light from the foot of the tree. It appears that the bracket and the crust never occur together, one or other form being assumed by the fructification.

In the forests of the Risoud mountains as in many old stands of the Joux valley, where *Tr. Pini* is relatively common, the spreading bracket form seems to be unknown and the fungus appears to manifest itself solely by the formation of crusts that sometimes cover a large part of the lower surface of the branches and attain considerable thickness. The bracket form of fructification only occurs under the axils of certain branches or in the place of branches that have disappeared, but the fructifications remain small and project little from the surface, being more like triangular or heart-shaped crusts slightly thickened and arranged on the trunk in the order of the fallen branches.

The relatively serious injury to the forest of the Joux valley caused by *Tr. Pini* is due to the great age of the trees forming many of the stands. Most of the large forests of the valley are composed of trees between 300 and 400 years of age, while in the other woods of the district individuals from 200 to 300 years old are still common. Apart from the great age of the trees and their consequently diminished powers of resistance due to reduced resin production, it is easy to understand that a disease which has been developing in a trunk for 1, 2 or even 3 centuries must necessarily have caused advanced decay in the tissues of its host. In crossing the Risoud valley a tree trunk may often be seen almost entirely reduced to a powdery mass not unlike tobacco in appearance. Hence the term "snuff box" or "tobacco plant," applied by the foresters and timber-merchants of the district to trees that have been severely affected by the

disease, and owing to the state to which they have been reduced by the prolonged attack of the fungus, are judged on felling to be useless and too decayed even for fire-wood.

121 - *Phomopsis Pseudotsugae*, Deuteromycete Parasite of *Larix leptolepis* and *Tsuga Albertiana*, in Scotland (1). - *Transactions of the Royal Scottish Arboricultural Society*, Vol XXXV, Pt 1, pp 73-74. Edinburgh, Sept. 1921.

In the autumn of 1920, symptoms of a disease on stems of the Japanese larch (*Larix leptolepis*) were noted in Bowmont Forest, (near Kelso). At that time it did not seem to be of a serious nature. The fungus appears to be identical with *Phomopsis Pseudotsugae*.

As a result of the examination of the specimen from Bowmont Forest Dr. M. WILSON has stated that the Japanese larch is without doubt attacked by this fungus, the first record of *Phom. Pseudotsugae* on *L. leptolepis*.

During May 1921, the fungus was found on the dead leading shoots of young trees of *Tsuga Albertiana* in Fifeshire.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

122 - On the Subject of Myrmecophily. - DI WU DI MAN, L., in *Comptes rendus hebdomadaires de la Société de Biologie*, Vol LXXXV, No 32, pp 844-876. Paris, November 12, 1921.

On several occasions, the author has asserted that myrmecophily exists among plants, and has drawn attention to the fact that this association is rarely a case of true symbiosis, but rather one of parasitism. This parasitism would often seem indeed to be of an accidental character, for it is not always indissolubly connected with a specific type.

A certain number of biologists regard myrmecophily as a means of defence for plants, but many naturalists ridicule this statement, and, although they may not be right in every case, it must be recognised that ants are frequently no protection to their host.

J. MASSART, who regards the plants and ants association as a means of protection, classes myrmecophilous plants in 4 groups :

plants with nectaries Ex: *Vicia*

» » dwelling places for ants Ex: *Miconia*

» » dwelling-places and nectar Ex: *Balschia*

» « nectar and albuminoid substances Ex: *Cecropia*, *Acacia*.

The author does not however think that these cases are exhaustive, for he has frequently seen ants installed on a plant without any special attraction such as the presence of cavities, or nectaries.

In the Congo, plants are to be found bearing on their aerial parts small ant-nests which have no connection with the ground. These plants do not appear to benefit in any way from the presence of the ants, which cause them to be infested by coccids. The ants, which in most

(1) See also *R.* Jan 1921, No 110, and *R.* March 1921, No 345. (*Ed.*)

cases are certainly responsible for the arrival of the coccids, construct around them kinds of nests made of plant debris bound together by a cement. Within these dwellings the coccids find shelter and obtain food from the tissues of the plant, while their secretions serve to nourish the ants. The association ("plants and ants") in this case is reduced to a species of indirect parasitism.

The author recently observed similar aerial ant-nests on the branches of the *Tilliacea*, *Grewia subargentea* n. sp. This plant cannot properly be classified in one of the groups proposed by MASSART, for though its petals are provided with nectiferous glands, they do not seem specially to attract the ants.

The plants of *Gr. subargentea* on which the ant-nests were discovered came from Avakubi and Beni, where they were collected by Dr J. BEQUAERT; they formed liane like shrubs growing on the banks of streams. The ant-nests were localised on the stems, especially in the axils of the leaves, round the peduncles, and petioles, and very often in the inflorescences around the points of their ramification.

Myrmecophily seems to be accidental in the case of this *Grewia*, for specimens of the same type of plant but coming from other places between Masisi and Walikale, Nala, where they were gathered in the forest, were free from these aerial ant-nests.

This would seem to support the theory of BUSCALIONI and HUBER who believe that myrmecophilous plants grow on land subject to flooding where the ants, as they cannot build an ant-hill on the ground, seek a refuge out of reach of the water.

The author states again that he considers myrmecophily to be a very common phenomenon among plants, but not to be explained by any single theory.

Most plants could become the supports of ant-nests, and be ranked among the ant-loving species. These nests are, as has already been said, stables in which the ants keep coccids, in order indirectly to obtain part of their food at the expense of their host. In the opinion of the author myrmecophily would appear to be an association which is often accidental, and very one-sided in its advantages for it always ends in doing injury to the plant.

123 - **The Effect of Phylloxera on the Quality of Grapes.** — SANNINO, F. A., in *Rivista di Ampelografia*, Year II, No. 11, pp. 169-170, Leghorn, November 1, 1921.

In the district of San Gervasio, in the Commune of Neive, Province of Cuneo, a vineyard attacked by phylloxera has for two years been treated with carbon disulphide in the hope of enabling as many vines as possible to bear grapes. Year after year, the weakest vines, which already produce but little fruit, continue to wither and are uprooted before they die.

The following results were obtained from the analysis of two samples of grapes gathered on September 25, 1921, the one being taken from a luxuriant productive Barbera vine, and the other from a plant of the same

variety, but evidently suffering from phylloxera, as was shown by its weakly appearance and poor yield.

*Composition of the Must from Barbera Grapes.*

	Not attacked by phylloxera	Suffering from phylloxera
Sugar . . . . .	gm. 226 ‰	gm. 215 ‰
Tartaric acid . . . . .	" 12.5 ‰	" 12.3 ‰
Colour . . . . .	very bright red	less intense red

If the season had been less favourable to the ripening of the grapes, the author believes that the differences would have been greater, as they were in vineyards attacked by phylloxera which had not been treated with carbon disulphide.

The author states that he had heard it said for many years that phylloxera is a cause of deterioration in wines. He obtained a confirmation of this theory in August 1921, when he examined a sample of choice wine made from the grapes of Sauvignon and Sémillon. This wine, which came from a vineyard where the phylloxera had taken such hold that all the vines have now been uprooted, had become a totally inferior product.

Whenever it is necessary for special reasons to preserve a phylloxera infested vineyard, in order not to lose the large returns it brings in, it must be treated (as is done in Champagne) with carbon disulphide and manured with chemical fertilisers. The former lessens the injury wrought by the insect; while the latter stimulate the vine and increase its productivity.

RESISTANT  
PLANTS  
MEANS  
OF  
CONTROL

124 — **Wood of *Pterocarpus* Resistant to White Ant.** — See No. 51 of this *Review*

125 — ***Drosophila rubrostriata* and *Phora Chlorogastra*, Diptera Recorded as Parasites of the White Cabbage Butterfly (*Pieris brassicae*), in France.** — BONNAMOUR, S., in *Bulletin de la Société entomologique de France*, No. 15, pp. 217-219 Paris, 1921

During the summer of 1921 a small field of cabbages at Saint-Genis-Laval, in the neighbourhood of Lyons, was destroyed by a large number of the caterpillars of the White Cabbage Butterfly (*Pieris brassicae*).

From these caterpillars were reared numerous specimens of *Apanteles glomeratus*, and of the tachinid *Compsilura concinnata*, as well as a fair number of small Diptera. Among the latter VILLENEUVE recognised *Drosophila rubrostriata* Beck, and one individual of *Phora chlorogastra* Beck.

*D. rubrostriata* was first recorded in the Canaries, and was carried to the Pasteur Institute by bananas imported from those islands to serve as food for the monkeys kept at the Institute. It is also found in tropical Africa.

The representatives of the family *Drosophila* live on decomposing

organic matter of either animal or plant origin. Their parasitism on the caterpillars had not before been recorded. The observations so far made seem to show that *D. rubrostriata* is able, no doubt by simply depositing its eggs, to bring about the decomposition and liquefaction of the Cabbage Butterfly caterpillar, while on the other hand *C. concinnata* causes it to dry up.

*Ph. chlorogastra* is a rare southern species reported from Ragusa; it appears to have become acclimatised like *D. rubrostriata* in the Lyons district. The fact that these two Diptera are parasites of *P. brassicae* was however hitherto quite unknown.

126 — The Introduction into France of *Aphelinus mali*, the American Parasite of the Woolly Aphis of the Apple-Tree (*Eriosoma lanigera*) (1). — MARCHAL, P., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, vol. VII, No. 28, pp. 619-625. Paris, 1921.

On June 4, 1920, the author received from the Head of the Bureau of Entomology of the Department of Agriculture of the United States some branches of apple-tree covered with the parasite *Eriosoma lanigera* Hausm. (woolly aphis). All the aphids were attacked by a small Chalcid Hymenopteron of American origin — *Aphelinus mali* Hald., which in its larval stage, is an internal parasite of the Aphis. Some deformed elm shoots in the shape of rosettes, containing individuals of *E. lanigera* that had been killed by the above-mentioned Hymenopteron, were forwarded at the same time.

Between June 10 and 19, this material furnished rather over 100 adult specimens which formed the first generation of *A. mali* reared in France. Most of them were collected in muslin bags, and distributed among the apple-trees in pots infected by *E. lanigera* at the National Agricultural Institute in Paris.

The second generation of the Hymenopteron, which was necessarily limited owing to the conditions of captivity in a confined space, began to appear on July 1, and continued hatching out until July 28. From this date, the rearing of the insects in Paris was gradually given up and the adults of *A. mali* that had been obtained were despatched in tubes and in muslin bags to three different centres, Antony (Seine), Montargis (Loiret) and Rouen.

By the end of September, five generations composed of thousands of individuals had succeeded one another at the breeding-stations, so that the number of centres could be increased in view of the multiplication of the species. Colonies were made at different points in the vicinity of Paris, and consignments forwarded to the Entomological Stations of Bordeaux and of Saint-Genis-Laval near Lyons. *A. mali*, in the larval or nymphoid stage passed the winter in the open, under the best conditions, in individuals of *E. lanigera* which succumbed to its attacks and

(1) See also R. June 1921, No. 692. (Ed.)

were recognised by their black colour. The eggs of the Chalcid began to hatch out at the end of March 1921.

As a precaution and in order to avoid any risk of destruction, the hymenoptera had generally been reared in 1920 within sheltering muslin bags.

In 1921, these bags were only used in the formation of new centres, the author himself adopting dispersal cages. Two such cages were made at Antony on his own estate, one of them covered a plantation containing 20 young apple-trees (Paradis) which had been intentionally placed very close together. They were infected with *E. lanigera* in the spring, and later furnished with a liberal supply of *A. mali*. The other cage was attached to a large espalier apple-tree infested with *E. lanigera* on which *A. mali* had begun to breed either in muslin bags or unprotected during the preceding year.

The cages are covered with a gauze coarse enough to allow the escape of the insects that had hatched on the boughs, but sufficiently fine to protect them against *E. lanigera*, and also *A. mali* during their larval and nymphoid stages.

Simple gauze bags used on a smaller scale proved of great value in establishing breeding centres.

By this means the author obtained from the time the 2nd generation were hatched in the spring, hundreds of thousands of *A. mali* which dispersed themselves throughout the garden and extended their boundaries, generation after generation, to such an extent that at the present time the estates adjoining the author's property are full of these Hymenoptera. They have been found breeding in places away from the main roads and tree screens within radii of 300 to 400 metres around the original centre of dispersal. A large cage 4 m. in height has been placed over two young apple-trees growing in the open near Bourg-la-Reine, where the progress of dispersal can also be well studied. Other similar cages have been set up in different places, notably at Montargis and Rouen.

Finally, owing to the large supply of material obtained in 1921, it has become possible to send boughs attacked by woolly aphids and infested with the parasite to many Stations: Orleans, Nantes, Angers, Rennes, Alençon, Noyon, Pont-de-l'Arche, Havre, Toulouse and also to many communes in the neighbourhood of Paris (Châtenay, Plessis-Piquet, Fontenay-aux-Roses, Versailles, Brétigny, Villejuif, Saint-Maur, Maison-Lafitte, Livry and Montmorency). It is almost certain, that the latter colonies will not all survive, but experiments made at Antony and Bourg-la-Reine have proved the possibility of breeding and dispersing *A. mali*, and it now appears, that its acclimatisation throughout France and in the various countries of Europe is but a question of time.

As regards the practical effects of its acclimatisation all that can be said for the present is, that the useful part played by *A. mali* is clearly demonstrated by the enormous number of woolly aphids destroyed by it (as is shown by their black colour) which in summer cover the apple-branches in a well-established centre such as that of Antony.



As long as the buds of the apple-tree are growing rapidly, the woolly aphid multiplies faster than *A. mali*, but when the growth of the tree stops in the summer, *E. lanigera* increases more slowly. *A. mali* then contributes greatly to hasten its decline, supplementing the efforts of the native predatory insects whose efficacy varies according to the year and the place.

The author mentions facts, which he has himself observed, connected with the life-history of the Hymenopteron.

- 127 - **Economy in Hydrocyanic Fumigation.** - SCHIERHOLZ, C., in *Oesterreichische Chemiker-Zeitung*, Year XXIV, No. 22, p. 166, Vienna, November 15, 1921.

When hydrocyanic fumigation is carried out at low temperatures, only from 80-84 % of the hydrocyanic acid is liberated in 3 or 4 hours, the rest, 16-20 %, remaining in solution. Thus, in a warehouse (mill), of which the cubic content is 33 000 m<sup>3</sup>, in order to obtain a concentration of 1 % in volume of hydrocyanic acid, 3,30 m<sup>3</sup> would be needed, and calculating the amount remaining in solution, 200 kg. of cyanide of sodium, or 270 kg. of cyanide of potassium, would be required; this means 800 gm. of the latter salt per 100 m<sup>3</sup> of empty space. The present prices of cyanides make it worth while trying to find some way of reducing the amount used. It must be remembered in this connection, that the toxic action of hydrocyanic acid, like that of carbon monoxide, is due to its asphyxiating property, and that the chief antidotes are oxygen and permanganate. For this reason, an attempt was made to decrease the oxygen content of the air, either by using a solution of pyrogallic acid, or by burning vegetable charcoal. In this way, it has been found possible to reduce the oxygen of the air by 15-20 %, which is sufficient to render the action of the accumulated hydrocyanic acid 4 times as efficacious, and hence to reduce the consumption of cyanide by that amount. In 4 to 5 hours, all the insects and their eggs are destroyed and after one hour's ventilation, the air has become normal.

- 128 - **Insects Injurious to Lima Bean (*Phaseolus lunatus*) in Egypt.** See No. 37 of this Review.

INSECTS, ETC.  
INJURIOUS  
TO VARIOUS  
CROPS

- 129 - **An Undetermined Dipteron Injurious to Lucerne, in France.** - DELNAIFFE and COILLÉ, in *Journal d'Agriculture pratique*, Vol. II, No. 11, p. 313, figs. 2. Paris, Oct. 15, 1921.

During the course of experiments carried out in the experiment fields at Carignan for the purpose of determining the comparative early maturity of different types or kinds of lucerne, the authors had occasion to notice a malformation of the flowers of this Leguminosa which rendered them quite unrecognisable.

This deformity was due to the hypertrophy of the lower part of the leaves of the corolla which caused the tips to curve slightly inwards, giving the flower a globular appearance, its petals being arranged so as to form a cone. The malformed blossoms had a very long flowering period and retained their freshness for an unusual time. They were produced

for over three weeks and remained unopened until they withered late in the season.

It was curious to see on the same inflorescence, in spite of its centrifugal development, normal spiral pods at the top where the flowers were normal and malformed flowers at the base still in the flowering stage.

Under the pressure of the corolla that has grown vesicular, the calyx becomes distended and splits on the back of the flower where it remains wide open, whereas the five subulate teeth terminating the calyx all lie on the ventral side.

On cutting one of these flowers in two, according to its plane of symmetry, and examining with a strong lens the sections thus obtained, it will be found that the interior is full of the small larvae of a Dipteron, which has hitherto not been determined, and of which as many as 12 to 20 grubs may be seen in a single flower.

In the vesicular portion the tissues of the hood are hypertrophied and the thickness of the cut surface is much greater than in a normal flower. The same change takes place in the tissues of the tube of the stamens which has the appearance of a transparent, thick and rigid column.

It is to be noted that in spite of the presence of numerous parasitic larvae, no part of the flower appears to be injured. The larvae live on the surrounding nectar, the hypertrophy of the nectaries having the effect of increasing the flow. All the deformed flowers remain sterile although their reproductive organs are uninjured. When therefore, as in 1921, they occur in large numbers, the seed production is greatly reduced.

130 - *Paria canella*. The Strawberry Rootworm in California. - URBANUS, T. D., in *Monthly Bulletin of the Department of Agriculture, State of California*, Vol. X, No. 8, pp. 311-313, figs. 3. Sacramento, California, 1921.

*Paria canella* has frequently been referred to as a pest of strawberries and *Rubus* spp. in the eastern parts of the United States. The first mention of this pest was made in 1880, and it has since been reported as a strawberry pest of secondary importance in the States extending from the Rocky Mountains to the Atlantic coast. It came to the attention of Californian growers three or four years ago when its destructive work on the foliage was first noticed. The insect had without doubt been present in smaller numbers for several years previously as it was found to be quite widely distributed. It is found over several widely separated areas in the Sacramento, San Joaquin and Santa Clara valleys. Probably about 300 acres are at the present time abundantly infested and on some of these fields, the strawberries have been practically destroyed.

The adults hibernate in the fields where they may be found active on the warmer winter days. They feed on the leaves in early spring and may be seen in large numbers in early March, when a dozen or more may frequently be found on a single plant. Eggs are deposited on the plants and in soil crevices. The first eggs are laid in the latter part of March

and this continues until May. The maximum is reached in mid-April. The larvae appear in June and soon work their way to the finer roots of the plant. A few of the adults continue throughout the summer, constantly attacking the newly forming leaves. The larvae are fully developed and pupate in July; the new generation appears in early August. These feed ravenously and riddle the leaves. Under Californian conditions, the most severe visible injury results from this attack on the leaves in the autumn and early spring, but the plants suffer even more in mid-summer when the larvae attack the roots and cause the plants to wilt. Punctures made on the leaf stems result in the drying of many leaves and punctures on the fruit give rise to irregular formation and frequently encourage premature decomposition and decay.

A short description is given by the author with reference to the remarkable fecundity of this beetle, and its ravenous attack shows that it is of more than secondary importance to the Californian growers.

Fields infested should be sprayed with arsenate of lead (3 lb. to 100 gall. water), or dusted with Paris green (1 lb. to 6 lb. flour). This treatment should be given as soon as the newly-emerged beetles have appeared, usually about the latter part of August.

Burning the fields is of some value in destroying hibernating quarters for adults, but they escape destruction from the flames by taking refuge under clods and in soil crevices.

Where beetles are found in the spring, fields may be treated with one of the above-mentioned insecticides after the spring rains and before the maximum flowering period.

Poison-bran mash prepared according to the regular formula as used for grasshoppers, has been used with considerable success after the berries began to develop when it is too late to use the insecticides. It has been reported that beetles were found to feed freely upon the poison bait.

131 - On the Presence of the Coccid, *Icerya purchasi* in the Neighbourhood of Paris. — VAYSSIÈRE, P., in *Bulletin de la Société entomologique de France*, No. 15, pp. 215-216. Paris 1921.

A little distribution centre of *Icerya purchasi* has been discovered at Suresnes (Department of the Seine). This appears to be the first time that this scale-insect has been recorded from so high a latitude as that of Paris. The parasite was introduced into the district on young plants of *Acacia* sent from Cannes, and has succeeded in thriving at Suresnes since February 1921. The immediate and thorough destruction of this small centre of infection has been advised.

132 - *Icerya purchasi* in Hérault. — LICHTENSTEIN, J. I., in *Bulletin de la Société entomologique de France*, No. 16, pp. 239-241. Paris 1921.

The coccid, *Icerya purchasi*, already recorded as occurring in France in the Alpes-Maritimes (1) and in the district of Paris (2), has also been

(1) See R. July 1913, No. 891. (Ed.)

(2) See No. 131 of this Review. (Ed.)

discovered in large numbers in a garden at Montpellier (Hérault). Specimens of the insect collected in the district are preserved at the Montpellier School of Agriculture. PICARD and GRASSÉ also found this insect in March 1921 on an acacia in a nursery-garden at Montpellier, but this information has not been published.

In the garden where the author observed *I. purchasi*, the insect was present in enormous numbers and had caused the death of acacias and several specimens of *Glycine* (*Wistaria*), *Sophora japonica* and *Robinia*. The author even found a single specimen on a foreign conifer. The coccid has lived for about two years on these trees and is therefore well able to withstand the winter cold. The author does not think however that it has spread much since its introduction. The place where he found it had a southern exposure and was sheltered from the wind. These conditions have enabled it to develop greatly within a relatively small area, and the author saw none of these coccids on trees growing outside a radius of 20 metres. It should also be noted, that some maples and plane-trees which were literally covered with *Ceroplastes* were quite free from *Icerya*.

The spread of *Icerya* to Hérault must be due to the transport of infected trees; thus its presence is explained in several well-defined spots where it has multiplied intensely, but it only finds its way slowly to other places in the neighbourhood. Although the natural spread of the parasite seems to have been very limited and circumscribed in the cases mentioned, the insect once introduced to a new place rapidly increases, as the author has recently had occasion to observe.

133 - *Agrilus foveicollis*, Coleopteron Injurious to Roses in Bulgaria. —

MOKRZECKI, S. A., in *Bulletin of Entomological Research*, Vol XII, Pt 3, pp. 353-354 + 1 fig London, Nov 1921

In May and June 1921, the author made investigations as to the cause of the serious losses that had occurred among the rose trees (especially *Rosa damascena*) which are extensively grown in Bulgaria for making attar of roses. It has been concluded that the cause of the decline in rose culture is inadequate plant nutrition, owing to an insufficient amount of humus and nitrogen in the soil, aggravated by the neglect of manuring by the growers.

But the immediate cause of death of thousands of rose bushes has proved to be certain galls that are to be found on the stems, reaching 2-3 cm. in length and sometimes as thick as the normal stem. Several galls have been found on a single stem.

When a gall is cut open, dark-coloured burrows may be seen circling the stem just under the bark, the number varying from three to fourteen. Up to the present however no insects have ever been found in these galls and previous investigators attributed them to the coleopteron *Agrilus viridis* L. Injuries of this kind have also been recorded on roses in Italy and France and HOUARD considers them due to the activity of some microlepidopteron.

The author's investigations have however led him to conclude that the galls are caused by the larvae of *Agrilis foveicollis* Mars, a species described in Siberia and never previously recorded for any locality in Europe.

The adult beetles appear in mid May and live on the leaves of roses, nibbling their margins. The female lays her eggs (up to 30) each separately under the bark of one-year-old shoots. The eggs hatch after 5-7 days and during the first 2-3 days of its life, the larva may make as many as three annular burrows round the shoot and under the bark, filled with black excrement. No swelling however is formed during the first summer; the second year, this is noticeable and increases gradually while the shoot begins to dry up. In the third year, the whole stem slowly dries up. The life of the larva lasts apparently about one year, and hence the reason that larvae are not to be found in the galls which are already well formed.

134 - *Laspeyresia molesta*, a Microlepidopteron Injurious to the Peach and Other Fruit Trees reported in Liguria, Italy (1). — PAOLI, G., in *L'Agricoltura coloniale*, Year XV, No. 12, pp. 572-576, pl. 1. Florence, December 1, 1921.

It has recently been observed that the Tortrycid, *Laspeyresia molesta* Busck, already reported as occurring in Japan, Australia and the United States, is also to be found in Italy, and is even of common occurrence in Liguria.

The caterpillar of this Microlepidopteron lives at the top of the branches of the peach-tree, where it excavates a gallery, thus destroying the terminal bud and causing the branch itself to wither for a distance of 5 to 6 cm. The parasite chiefly attacks trees still in the nursery, or the most vigorous individuals that have been planted out.

The peach-tree is the favourite plant of *L. molesta*, but in Liguria, the insect also attacks young nursery specimens of almond and apricot and is at present but rarely found on *Prunus persica*.

Toward the end of the autumn of 1920, the author discovered in the branches of a peach-tree near Savona, a caterpillar having apparently the characters of *L. molesta*, but it was not until 1921 that he obtained the adult insect and was able to identify it as belonging to the species in question. He found it to be wide-spread and very common from Ventimiglia to Sestri Levante. During a short excursion to Mentone, when the season was already far advanced, the author observed the tops of many of the peach-trees to be injured in such a manner as to justify the belief that this Microlepidopteron also exists in France.

He has not been able to discover in what manner or at what date the insect was introduced into Italy. American varieties of peach-trees are to be seen everywhere in Liguria, but there is no proof of their direct importation from the United States. They have been acquired through the agency of well-known merchants and nursery-gardeners; thus the

(1) See *R. Mar.* 1917 No. 300; *R.* April 1921, No. 443 (*Id.*)

parasite must occur in a number of other districts in Italy, unless it is to be believed that the whole of one infected consignment was sold in different parts of Liguria.

According to the investigations made, it would appear that the withering of the tips of the branches has only been noticed by the Ligurian agriculturists during the last 6 or 7 years. It is not however likely that the *Microlepidopteron* was introduced so recently, for all insects escape observation at first; further nearly two hundred kilometres of the Riviera, from Ventimiglia to Sestri Ponente have been invaded by *L. molesta*.

The author describes the different stages of the insect's development and the injury it occasions.

No really efficacious means of controlling this Tortrycid are at present known

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INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

A B S T R A C T S

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

- 135 - Agriculture in the State of São Paulo, Brazil, According to the President's Message to the Legislative Congress (Session of July 14, 1921). — *Industria e Comércio*, Year VI, No 55, 30 pp. Rio de Janeiro, July 31, 1921.

DEVELOPMENT  
OF  
AGRICULTURE  
IN  
DIFFERENT  
COUNTRIES

The greater part of the Message of the President of the State of São Paulo, Dr. Washington Luis PEREIRA DE SOUZA, is concerned with the economic and financial condition of the country during the difficult period beginning with the termination of the European War. He describes the measures taken by the Government to alleviate the serious crisis which was due : to the sudden fall in price of all articles of food, the decreased consumption of the countries that had previously been the chief importers of Brazilian products, the resumption of home production in those countries, the precarious condition of the Brazilian market owing to the sudden influx of North American goods, in quantities that far exceeded the demand, thus causing the export of gold coinage and the rise of the exchange which was already very high owing to the above mentioned causes, etc.

In São Paulo the crisis first affected stock-breeding and the industries of which it is the basis : cold-storage plants, tanneries, boot-factories, etc., but it soon extended to cereal production and the cereal trade, cotton-growing and the cotton industry, etc. The coffee crisis was not occasioned, as in the other cases, by an excess demand over supply, but by the fact, that there was a severe frost in the State on June 25, 1918, which destroyed the year's crop and reduced by 70 % the normal yield for the two following seasons.

The President has carefully studied the best means of organising Credit Institutes in order to tide over the present difficulties and prevent their occurrence in the future. He deals chiefly with the necessity for founding a Central Bank of Credit and Discount.

The taxes of the year 1920 brought in a total of 175 678 985 *milreis*, of which 27 266 750 were furnished by export dues, 13 120 by the sale of public lands and 380 246 by the sale of holdings to groups of colonists.

IMMIGRATION AND PROTECTION OF THE AGRICULTURAL WORKER. — Immigration, which was suddenly arrested by the outbreak of hostilities in Europe, has now resumed its normal proportions. In 1920, 44 553 immigrants entered the State of São Paulo; of these, 32 484 landed at Santos.

The President considers that the present form of settler's contract cannot be improved upon, as it allows the settler working at the "fazenda" to save money and thus acquire the position of small-holder or merchant.

The "Patronato agrícola" protects the rights and interests of the rural workers, and acts as arbitrator in the case of difficulties arising between employers and their men; it gives advice to rural workers and land-owners, settles strikes etc.

AGRICULTURAL INSTRUCTION. — This is given at the following Institutions: a) The "Escola agrícola Luiz de Queiroz", which confers an agricultural diploma and had 103 pupils and 10 students attending lectures, in 1920; b) The "Instituto de Veterinária" opened in April 1920, with 17 students.

The State also provides for general instruction (both secondary and University teaching), as well as for the education of persons entering professions or trades.

GOVERNMENT MEASURES FOR THE ENCOURAGEMENT OF AGRICULTURE. — *Instituto agrônomo do Estado*. — The director of this Institute answers written or verbal questions regarding agriculture; in his chemico-bacteriological laboratory are carried out analyses of soils, fertilisers, insecticides, agricultural produce (which is also examined when adulteration is suspected), experiments in agricultural microbiology and plant biology, etc., and its services are also at the disposal of private individuals. The Institute has an experimental and demonstration coffee plantation, where the theoretical and practical study of the systematic cultivation of the coffee plant is carried out. There is also an experiment field for polyculture, where the improvement of farm-crops, the best methods of growing crops on a large scale, the best varieties of plants grown, the acclimatisation and selection of plants, the most favourable dates for sowing, etc. are thoroughly studied. In 1920 the Institute distributed 174 450 plants, including fruit-trees, ornamental plants, sugar-canes, coffee trees (cuttings, grafted stocks, rooted cuttings).

The *Forestry Service* supplies trees gratuitously to public Institutions, and at a low price to private persons. In 1920, it distributed 1 577 826 trees; of these 1 517 865 were forest-trees, and 59 961 fruit-trees.

The *Meteorological service* possesses 111 Stations in the State of São Paulo.

*Propaganda of "Agricultural Protection"*. — The "Directoria de agricultura" not only brings to the notice of agriculturists the methods that experience has shown to be the best for obtaining good crops, but



also directly assists by its advice and efforts in lessening the injury caused to cultivated plants by pests and parasites. Chief among these is the Pink Cotton Boll-Weevil "*lagarta rosada*" (*Platyedra* [*Pectinophora*] *gossypiella*), an insect remarkable for its diffusion and the great injury it inflicts on the cotton crop.

*Novius cardinalis* has been introduced and become acclimatised, and its power of controlling *Icerya purchasi* ("pulzão branco") has already been observed. Studies and experiments are being carried out with a view to the extermination of the "formiga sauva" (ternrite).

The "Directoria de Agricultura" distributed in 1920 36 614 kg. of Paris green, 17 020 kg. of white arsenic, 9 216 kg. of flowers of sulphur, 2 279 kg. of copper sulphate, and 53 boxes of carbon disulphide.

The Service for the Inspection and Sorting of Cotton Seeds continues the inspection of the ginning establishments, in order that no seed infected with bollworm may be planted: 327 of these establishments were inspected. The trucks in which the sorted seeds are transported are also disinfected.

*Sale of Agricultural Implements at Cost Price.* — 29 007 picks and spades, 10 301 pickaxes were sold as well as pitch-forks scythes, drills, PLANET harrows, etc.

*Seed Distribution.* — In 1920, 8 709 kg. of seed were distributed to 2 436 persons.

*Publications Service.* — The "Secretaria de Agricultura" of the State of São Paulo has 3 official publications: *Boletim de Agricultura*, *Boletim de Industria e Commercio*, *Boletim de Importação e Exportação do Porto de Santos*. The number of publications (including periodicals) distributed in São Paulo amounted to 220 000.

*Coffee Propaganda.* — This work is entrusted to different companies; the contract for Japan being given to the "Companhia Café Paulista" of Tokyo, and that for the United States to the "Sociedade Promotora".

*Measures for the Encouragement of the Stock-Breeding Industry.* — In 1920, the "Directoria de Industria Pastoral" distributed over 200 000 doses of vaccines against infectious cattle-diseases. This office was wound up in 1920, and since then the vaccines have been sold by the Ministry of Agriculture to the breeders entered on its registers.

The Police Veterinary Service was instituted by Decree No. 3141 of January 13, 1920. This Service has succeeded in confining minderpest to a very limited area, and in rapidly suppressing it; the disease having been rife throughout the state of São Paulo at the beginning of 1921. The method employed consisted in the marking out of the infected area and the destruction within this area of all animals likely to contract the disease; 1454 cattle were slaughtered and their owners indemnified.

Good results have been obtained at many Stud Stations. At the "Posto de Seleção do Gado Nacional" the work of improving the Caracú cattle has been continued (1) and at the "Haras paulista" the native horse

(1) See R. 1911, No. 1825; R. 1912, No. 1438; R. 1916, Nos. 1093 and 1195; R. 1917, No. 1044. (Ed.)

is being improved (1). The "Fazenda de Criação" of Barnery is chiefly engaged in pig-breeding, but pure Schwytz cattle are also bred there, the animals doing exceedingly well (2). The "Fazenda Sant'Anna" has become the centre of Dutch cattle breeding. The pure Red Poll race is also bred at the "Fazenda de Criação do Amparo"; the pastures and breeding methods in Brazil suit this breed of cattle. At the "Fazenda de Criação at Itapetininga, Hereford and Durham cattle are reared and also sheep. The "Fazenda Campininha" is set apart for the breeding of the native "gado mocho" cattle and to its improvement by selection and proper feeding. It is also engaged in the intensive and extensive cultivation of forage plants either native, or capable of acclimatisation. The results already obtained have been encouraging. The "Posto zootechnico" of Botucatú and São Paulo respectively are two popular Stud Stations; the latter is also a vaccination Station.

A cattle show was held on April 12. The first class animals (excellent), fetched 20 *milreis* per *arroba* (1 *arroba* = 33 lb. = 15 kg.); the second class (good), 18 *milreis*; the third class (fair), 16 *milreis* and the fourth class (disqualified), 15 *milreis* respectively per *arroba*.

AGRICULTURAL PRODUCTION. — In 1919-1920, the frequent and abundant rainfall was very beneficial to cereals, especially to rice. On the other hand the cotton crops were very small (only half the normal crop being produced on account of a reduction of the area under cotton due to the fall in prices and the attacks of parasites). Table I gives the chief crops obtained during the year in question and their value in *milreis* (1 paper *milreis* = about 1 s. 6 d.).

TABLE I. — *Agricultural Production in the State of São Paulo in 1919-1920.*

Products	Amount	Value in <i>milreis</i>
Coffee . . . . .	—	278 908 640
Unginned cotton . . . . . qx	688 245	43 588 840
Sugar . . . . . sacks	528 821	33 971 161
Brandy and alcohol . . . . . hl.	953 880	49 406 877
Tobacco . . . . . qx	32 326	68 807
Paddy . . . . . sacks	4 686 015	82 005 262
French beans . . . . . "	2 859 377	40 031 278
Maize . . . . . "	15 963 900	183 854 850

The value of the total agricultural production of the preceding year had been 955 606 300 *milreis*.

(1) See R. June 1921, No. 469. (Ed.)

(2) See R. Oct. 1921, No. 1031. (Ed.)

THE FROZEN MEAT INDUSTRY (1). — This industry is at present carried on at the Refrigerating Stations belonging respectively to the "Companhia Frigorifica e Pastoril" (at Barretos), the "Continental Products" (Osasco), the "Companhia Frigorifica de Santos" (Santos), and Messrs Armour (near São Paulo).

The capital employed in these establishments is 36 million of *milreis*. The three first used in 1919 :

238 664	cattle of a dead weight of	53 532 911	kg.
65 182	pigs	5 025 194	"
2 253	sheep	30 908	"

their output being : 34 748 747 kg. of frozen meat ; 4 609 279 kg. of chilled meat ; 13 016 400 kg. of fresh meat ; 2 458 679 kg. of tinned meat.

The value of this output was about 70 million *milreis*, as against 56 million in 1918.

The exportation of meat from the port of Santos began in 1914 with a first consignment of 1415 kg. and has progressed as follows :

Years	Frozen meat		Tinned meat	
	Weight in kg.	Value in <i>milreis</i>	Weight in kg.	Value in <i>milreis</i>
1915	7 946 745	5 739 112	93 325	132 700
1916	18 688 846	15 716 962	362 173	612 719
1917	29 134 755	26 388 613	1 097 129	1 738 224
1918	32 654 838	32 754 404	2 791 181	5 222 855
1919	32 033 736	35 606 480	2 877 745	6 683 553
1920	32 710 000	36 532 000	570 172	1 425 093

The chief markets for Brazilian frozen meat are : Italy, Great Britain, Egypt and France, the tinned meat mostly goes to Belgium and Great Britain, and the sale of this commodity has been much reduced by the loss in 1920 of the North American market.

INDUSTRY AND COMMERCE. — The value of the output of the manufacturing industries of the State of São Paulo continues to increase ; from 274 millions of *milreis* (in round numbers) in 1915, it rose in 1919 to nearly 713 millions.

In 1920, the value of the exports was 53 250 000 *pounds sterling*, or 860 million paper *milreis*, with a decrease of 227 million paper *milreis* as compared with the preceding year. This drop is to be attributed chiefly

(1) R. July 1921, No. 767. — Regarding the exportation of frozen and tinned meat from Brazil to Italy see : Dr. DROGECIO DE CAMPOS, A importação de carnes congeladas na Italia, in *Boletim do Ministerio das Relações Exteriores, Republica dos Estados Unidos do Brasil*, No. 9, pp. 49-2. Rio de Janeiro, 1920. (Ed.)

to coffee of which 9 426 335 sacks (of 60 kg.) of the value of 946 576 million of *milreis* were exported in 1919 as against 8 480 887 sacks of the value of 671 363 million *milreis* in 1920.

In 1920, the export figures for cotton were the highest hitherto registered being 11 260 tons of the value of 38 689 000 *milreis*, or about double the amount exported in 1919; 83 331 tons of rice of the value of 59 893 000 *milreis* were exported as against 8 846 tons in 1919.

The sea trade of the Port of Santos is now as great as before the War.

**SANITARY SERVICE.** — The Public Health Services continue to insure the interrupted improvement of the hygienic conditions of the country. They have at their disposal: vaccinogenic, bacteriological and Pasteur institutes, as well as factories where State quinine is made; services for the Inspection of food sold to the public (with Laboratories for the analysis of chemical products and foods); a corps of Sanitary Engineers; a Service for the Inspection of Chemists' shops; an Inspector of general prophylaxis; a Central Institute for Disinfection; a Hospital for Infectious Diseases, etc.

These Services also provide for the hygienic protection of infants.

#### RURAL HYGIENE

136 — **The Part Played by the Rabbit and Other Domestic Animals in Protecting Man from Mosquitoes.** — LEGENDRE, J., in *La Nature*, No. 2487. Paris, December 3, 1921.

There have been previous references to the rôle of animals in protecting man against the bites of the mosquitoes that convey malaria. Domestic animals living in the neighbourhood of human beings are attacked by *Anopheles maculipennis* in preference to the latter (1). The author, basing his opinion upon the observations made in collaboration with OLIVEAU, states that the rabbit is very useful in this connection. In many districts of France, the rabbit enclosures have been found to be infested with *Anopheles* when the stables and houses near were completely free even in summer. The young rabbits are bitten in the hairless parts of their bodies, viz., the ears and muzzle.

### CROPS AND CULTIVATION

#### AGRICULTURAL METEOROLOGY

137 — **Effect of Lake Michigan (United States) upon Rainfall during the Crop-Growing Season.** — ESHLEMAN, C. H., in *Monthly Weather Review*, Vol. 49, No. 9, pp. 500-502, figs. 2. Washington, September 1921.

Severe drought conditions prevailed during the early and middle crop-growing months of 1921 at Ludington (Michigan), and the storms seemed in some degree to avoid the shores of Lake Michigan although heavy rain fell in the neighbourhood.

These facts led the author to undertake a series of investigations with a view to determining whether the lake diminished the total rainfall.

The data obtained showed that for the three months May, June and July, there is an area of maximum rainfall in the interior of extreme Southern Michigan. In August and September this area is absent.

(1) See *R. Jan.* 1920, No. 1. (Ed.)

The rainfall is greater on the eastern than on the western shore, whereas an area of maximum distribution is found in the interior of Wisconsin (on the west of the lake).

The lake thus seems to cause a certain decrease in the rainfall which must be attributed to the wind blowing with greater force in the afternoons, during May, June and August and thus producing a lateral movement preventing the vapour-laden air from rising and its moisture from condensing in the form of heavy rain.

138 - **The Fertilising Value of Rain and Snow (1): Researches in Canada.** — SHUTT, F. T. (Chemist of the Dominion of Canada), Chemist's Report, in *Rapport des Fermes Expérimentales du Dominion. Fiscal Year Ending March 31, 1920*, pp. 58-59. Ottawa 1921.

A study begun in 1907 with a view to determining the sum of available nitrogen annually supplied per hectare by rainwater and snow; the water was collected and the analyses were made at the Central Farm in Ottawa. All the rainfall and the snow that have fallen during a year are separately measured and analysed. This latter is an important point for it was found at the beginning of the work, that the analysis of samples taken every month and preserved by means of an antiseptic does not give accurate results.

The laboratory work was limited to determining the free ammonia, albuminoid ammonia, and nitrous and nitric nitrogen. These three forms are those which make up the nitrogenous compounds present in atmospheric precipitations which are able to supply the crops with fertilising substances.

During the year ending February 29, 1920, 79 samples of rain and 24 of snow were analysed. The total precipitation registered for the year March 1, 1919—February 29, 1920 was 844 mm. of which 594 mm. were rain and 2502 mm. were snow (10 mm. of snow equals 1 mm. of rain). The total amount of nitrogen supplied by these precipitations was 7 971 kg. per hectare.

This enquiry brought to light many facts of scientific interest, but it will suffice in this short account to give such data only as are of importance from the agricultural standpoint. These are set out in the following Table together with similar data for the 2 preceding years for purposes of comparison, and the mean for the first decade of this experiment.

The rain and snow fall for the year are about normal. The mean for the 29 preceding years is 855.5 mm., but the amount of nitrogen supplied slightly exceeds the average given during the first 10 years of these researches. The latter show that the atmospheric precipitations in the neighbourhood of Ottawa supplied about 7.28 kg of available nitrogen per hectare. Of this amount 85 %, or about 6.6 kg., are supplied by the rain. The value of the nitrogen derived from the rain and the snow may be estimated, at a moderate computation, as 22.40 fr. per hectare (at par).

(1) See R. 1912, Nos. 39 and 620; 1914, Nos. 202 and 491; 1915, No. 677; 1916, No. 7; 1918, No. 956. (Ed.)

*Rainfall and Snow (in mm.) and Amount of Nitrogen supplied (in kg. per ha.)*

	Total amount m. m.	Nitrogen supplied		
		by the rain	by the snow	total
Year ending February 28 1918. . . . .	834.64	5.285	1.725	7.010
Year ending February 28 1919. . . . .	903.99	5.520	1.026	6.546
Year ending February 29 1920. . . . .	844.04	6.618	1.353	7.971
<i>Average of the 10 years ending on February 28, 1917. . . . .</i>	<b>842.52</b>	<b>6.142</b>	<b>1.223</b>	<b>7.375</b>

139 - **Influence of Atmospheric Factors upon the Composition of Wheat.** — See No. 160 of this Review.

140 - **Hard-Pan in the Apulian Soils and Its Origin.** — DE DOMINICIS, A. (Laboratorio di Chimica agraria, della R. Scuola Sup. di Agricoltura, Portici), in *Annali della Regia Scuola Superiore di Agricoltura in Portici*, Second Series, Vol. XVI, p. 18. Portici, 1920.

In a preceding paper the author (1) gave an account of the results of his researches on the hard-pan (« crosta pugliese ») of the soils of Apulia, especially in the district of Bari, where in many places the pan firmly adheres to the calcareous tufa that forms a rocky massive subsoil. The special conditions prevailing in the country round Bari are however not generally found in the rest of Apulia, for here the hard-pan rests for the most part on a friable, more or less finely divided calcareous soil into which roots can easily penetrate. This being the case the author decided to extend his researches to the other parts of Apulia and see how far the results obtained agreed with or differed from those of his previous investigations.

He employed the same methods as before, examining on the spot the position, conditions of formation, composition and properties of the hard-pan, its probable origin and the consequences of its possible removal.

These new researches bring out the general significance of the data previously obtained and also prove that hard-pan is not a phenomenon confined to rocky, massive sub-soils. They show that the formation of Apulian hard-pan in particular, and of all superficial calcareous pans in general, always depends upon the same set of conditions: a) the opportunity for their formation at the point of contact of the soil and the subsoil — b) a dry climate and a subsoil consisting of a rocky mass rich in calcium carbonate and with a very active capillary system — c) calcium carbonate dissolved in the capillary water, and the presence in the circulating water of sufficient colloidal substances in the form of reversible hydrogels and hydrosols — d) the co-existence of all these conditions which entails: 1) similar properties viz. a) a permeability limited to the first few moments of the action of the water and only to be detected by the application of certain methods — b) a capillarity not extending beyond the thin coating on the

(1) See R. March 1920, No. 293. (Ed.)

surface of the crust ; 2) similar chemical composition, the chief constituents being : a) calcium carbonate derived from the subsoil ; b) sandy and clayey matter from the soil.

Hard-pan is thus always formed in the same way and is due to the coagulations that take place when the colloidal substances found as hydrosols in the circulating water come into contact with the bivalent electrolyte, calcium carbonate, dissolved in the capillary water. The content and proportions of the crust depend upon the capacity of calcium carbonate absorption possessed by the resulting mass. These principles have been confirmed by new facts revealed by the present researches which have also shown how Apulian agriculture can be assisted by the improvement of both compact calcareous subsoils and non-massive calcareous subsoils. The first are more difficult to deal with than the second. Compact ground is however best broken up by the use of explosives, while friable soils only need superficial clearing.

141 - Researches made in Japan on the Gases Formed in Rice Fields during the Decomposition of *Astragalus sinicus* used as a Green Manure. — ONODERA, S., in *Berichte des Ohara Instituts für Landwirtschaftliche Forschungen in Kuraschiki, Province of Okayama, Japan* Vol I, Part 5, pp 557-558, figs. 12. Kuraschiki, 1920.

*Astragalus sinicus* L. is the plant chiefly used for green-manuring in Japan. Although it forms 71 % of the total of the Japanese green manures, it sometimes injures the rice crops, either on account of the nature of the soil or on the amount of the dressing applied. The author has already had occasion to try and discover the cause of its ill effects ; it would appear that these are to a certain extent due to the salts of the organic acids liberated during the decomposition of *Astragalus sinicus*. He subsequently found that the decay of this plant in the rice-fields gave rise to the formation of much larger quantities of gas than would be supposed. Much work has been done on the nature of soil gases ; and the researches of LEWY, BOUSSINGAULT, RUSSELL and APPLEYARD may be mentioned in this connection.

	Carbon dioxide	Oxygen	Nitrogen	
Cultivated soil . . .	$0.25 \pm 0.1\%$	$20.6 \pm 0.2\%$	$79.2 \pm 0.2\%$	{ RUSSELL and APPLEYARD, 1919
Winter meadow . . .	1.57	18.02	80.04	
Atmospheric air . . .	0.03	20.97	79.90	
Cultivated soil . . .	0.90	19.60	79.50	{ LEWY and BOUS- SINGAULT, 1853

According to RAMANN, the air of the soil contains 0.3 % of carbon dioxide, which is more than is present in atmospheric air, but soil air is free from methane and hydrogen. Researches on the gases of rice-fields have been made in India, though no author has considered the part played by

*Astragalus sinicus* in gas production. The author collected all the gases liberated during the summer of 1918 by the soil in a pot manured with *Astragalus sinicus* and then turned over. In 1919, he collected the gases from a rice-field fertilised with the same green manure. They included the gases from the slightly stirred superficial layer, the gas spontaneously liberated and the gases from the sub-soil. The soils studied were sandy-clays and clays.

The author's conclusions showed that *Ast. sinicus*, when used as a green manure for rice fields, set free large quantities of gas consisting essentially of methane, carbon dioxide, nitrogen and a small amount of hydrogen, the latter disappearing at the end of the decomposition process. Sometimes a little oxygen was found, which probably did not come from the decomposition of *Astragalus* but was a product of the carbon assimilation of the algae. If *Ast. sinicus* is left to decay in a rice-field, the gases of the subsoil contain more carbon dioxide than methane while most of the nitrogen is to be found in the upper layer. *Ast. sinicus* decomposes more rapidly in sandy soil than in clayey-sands and more quickly in the latter than in clays, hence the liberation of gases comes to an end sooner in sandy soil than in others.

It should be mentioned, that no liberation of gas from the control plots was observed and even had they formed a small quantity it would have consisted chiefly of oxygen, nitrogen and sometimes of small amounts of carbon dioxide; further, given its composition, this gas must be attributed to the carbon assimilation of the algae. It should be noted that the application of a little toluene soon stopped the liberation of gas.

142 - **The Inversion of Saccharose by the Mineral Acidity of the Soil.** — OSUGI, S., in *Bericht des Ohara Instituts für landwirtschaftliche Forschungen in Kuraschiki, Province of Okayama, Japar*, Vol. I, Part 5, pp. 579-597. Kuraschiki, 1920.

The power of inverting saccharose, a property possessed to a high degree by soils containing much mineral acidity, had already been demonstrated first by the author alone, and then in collaboration with RICE (1), as well as by SHARP and HOAGLAND. As the question had not been explained thoroughly, the author made further experiments using 11 samples of soil. He treated 5 gm. with 100 cc. of 5 % sugar solutions for 1 hour at 85° C, and then made the following determinations for the filtrate: the inverting power of the soil — the effect of the acidity of the soil extract — the effect of the temperature — the effect of various chemical agents — the effect of the different proportions of the degree of the acidity of the soil and its inverting property — the rapidity constant of the inversion reaction caused by acid soils.

The author then sought to discover the substances, whether extracts or insoluble (fine soil particles, silicic acid gel, or silicate of alumina), that might possibly cause the inversion of sugar.

His researches proved that a soil containing no mineral acidity un-

(1) See R. Feb. 1919, No. 158. (Ed.)



doubtedly has the power of inverting saccharose to a measurable extent, 1 to 9 gm. of invert sugar being obtained per 100 of saccharose. This property of inversion is to be attributed chiefly to the soil particles and is strictly connected with the degree of acidity of the extract obtained by treatment with a saline solution of potassium chloride.

The inversion produced by acid soil is a mono-molecular reaction similar to that effected by acids; on the other hand, aqueous extracts of acid soils are found to contain a little aluminium sulphate or chloride with acid reaction, but producing very little effect on the saccharose, whereas the gel of silicic acid can invert saccharose, but is not found in determinable quantities in acid soil. There is, however, an acid silicate (obtained by the precipitation with an aluminium salt, of an alkaline salt in an acid medium) that inverts saccharose and is the substance to which the great inversion power of acid soil is chiefly due.

The concentration of the hydrogen ions of aqueous acid soil extracts is not sufficient to cause inversion on the part of the soil, unless it is to be assumed that these ions are more concentrated in the film surrounding the soil particles than is any other part of the soil solution.

143 - **The Prevention of Dust Storms in Canada.** — MUNRO, W. A (Régisseur de la Ferme Expérimentale, Rostern Sask.), in *Rapport des Fermes Expérimentales du Dominion. Fiscal Year Ending March 31, 1920*, pp 171-172. Ottawa, 1921.

METHODS  
OF  
CULTIVATION

As much damage had been done in 1919 throughout the greater part of Saskatchewan by the removal of soil by winds, the author devoted his attention to a careful study of the question. From his observations and the results of his experiments, he reached the following conclusions:

1) Dust storms can be prevented to some extent by liberally manuring every 4 or 6 years.

2) Sowing grass-seed once in 6 years and allowing the grass to grow for at least 2 years is useful.

3) A clump of trees protects the ground on the leeward side for a distance of 15 m. for every 30 cm. of the trees' height.

4) No garden can succeed, unless it is protected by good wind-breaks in the shape of hedges.

144 - **The World's Nitrogen Products.** — *Journal of the Society of Chemical Industry*, Vol. XL, No. 15, pp. 285-287. London, August 15, 1921.

MANURES  
AND  
MANURING

The following data have been taken from the Statistical supplement to the Final Report of the Nitrogen Products Committee of the Ministry of Munitions. They show the present sources of the supply of these products which are most essential to agriculture and bring out the fact that the nitrogen fixation industry will in future be the chief source of nitrogen for the whole world, as can be seen from Table II.

The demand for fixed nitrogen is growing at a greater rate than the output capacity. As Table I shows, the potential output of the cyanamide plants is greater than that of the synthetic ammonia plants.

TABLE I. — *National Internal Sources of Fixed Nitrogen in Different Countries.*

Country	Population	Metric tons of nitrogen					
		From by-product sources	From fixation plants			Total	Tons nitrogen per million population
			Arc	Cyanamide	Synthetic ammoniac		
Germany . . .	65 000 000	150 000	4 000	120 000	300 000	574 000	8 830
Norway and Sweden . . .	8 000 000	—	30 000	28 000	—	58 000	7 250
United Kingdom	45 000 000	100 000	—	—	—	100 000	2 240
Canada . . . .	7 200 000	3 000	800	12 000	—	15 800	2 200
Switzerland . .	3 800 000	—	700	7 000	—	7 700	2 030
France . . . .	40 000 000	15 000	1 300	58 000	—	74 300	1 850
United States .	103 550 000	105 000	300	40 000	8 000	153 300	1 480
Austria . . . .	51 000 000	10 000	—	22 000	—	32 000	630
Italy . . . . .	35 000 000	3 000	1 200	18 000	—	22 200	630
Other Countries	—	27 000	—	20 000	—	47 000	—
Totals . . .	—	413 000	38 300	325 000	308 000	1 084 300	—

Table III gives a summary of the results of the World's Production of Fixed Nitrogen.

TABLE III. — *World's Production of Fixed Nitrogen.*

Sources	Metric tons of nitrogen			
	1919	1913	1917	1920
<i>Natural sources:</i>				
Chilean nitrate . . . . .	300 000	400 000	400 000	500 000
By-product industry . . . . .	240 000	353 000	400 000	400 000
Totals . . .	540 000	753 000	800 000	900 000
<i>Fixation process:</i>				
Arc and miscellaneous . . . . .	3 000	18 000	30 000	38 300
Cyanamide . . . . .	2 500	60 000	200 000	325 000
Synthetic ammonia . . . . .	—	7 000	110 000	308 000
Totals . . .	5 500	85 000	340 000	671 300
Grand total . . .	545 500	838 000	1 140 000	1 561 300
Proportion of total obtained by fixation processes . . . . .	1 %	10 %	30 %	43 %

TABLE II. — *The World's Resources in Nitrogen Production (Pre-War and Post-War Statistics).*

Source of supply	1912			1920		
	Output in long tons of product	Output in metric tons of nitrogen	Percentage of total output	Productive capacity of long tons of products	Productive capacity metric tons of nitrogen	Percentage of total productive capacity
Chili nitrate industry (assumed 95 % product) . . . . .	2 628 367	411 329	57.5 %	3 013 518	471 000	30.2 %
By-product industry (sulphate assumed 24.5 % ammonia) . . . . .	1 249 449	272 007	38.0	2 047 687	413 000	26.6
Fixation industry:						
a) assumed 18 % N . . .	128 563	22 435	3.1	1 805 432	325 000	20.9
b) nitrate of lime and arc process products (assumed 13 % N) . . . . .	76 200	9 907	1.4	295 046	35 300	2.5
c) synthetic ammonia . . .	—	—	—	1 527 048	308 000	19.8
Total: of fixation industry	204 763	23 342	4.5	3 627 526	671 300	43.2
Grand total . . .	4 082 519	715 678	100.0	8 688 731	1 555 300	100.0

145 - **The Condition of the Nitrogenous and Phosphatic Fertiliser Industries in Germany.** — UNGEWITTER, in *Chemiker-Zeitung*, Year XLV, No. 147, p. 197. Cöthen, December 8, 1921 (1).

The pre-War consumption of nitrogen in Germany amounted to about 240 000 tons, of which 40 000 were used in industry, and 200 000 in agriculture, not including the nitrogen supplied to the land in the forms of dung and green manure. This nitrogen was obtained : a) by the importation of the nitrate of sodium (in 1913, some 7 500 000 tons were imported, equivalent to 116 250 tons of nitrogen) ; b) by the importation of nitrate of lime (in 1913, 20 000 tons representing 2 400 tons of nitrogen were imported) ; c) by the home production of sulphate of ammonia (in 1913-1914, 500 000 tons corresponding to 110 000 tons of nitrogen were made) ; d) by the home production of calcium cyanamide (amounting in 1913-1914, to 50 000 tons representing 10 000 tons of nitrogen). During the War, these importations ceased. They were however replaced by the manufacture of ammonia on a large scale by the HABER-BOSCH high-pressure method, and of calcium cyanamide according to the FRANK-CARO process, but the ever-increasing need of munitions for the army encroached upon the supply of nitrogenous fertilisers for agriculture. After the revolution the nitrogen production fell to about  $\frac{1}{3}$  of the maximum output during the War, but it has gradually improved, so that according to the data of the Food Ministry, the amount of nitrogen supplied for agricultural use from 1914 to 1920 was as follows (in tons) :

1914	1918	1919	1920
200 000	92 000	115 000	158 000

In 1913 and 1914, 774 000 and 31 000 tons of nitrate of sodium respectively were imported into Germany. The maximum nitrogen output of the HABER-BOSCH process is estimated at 300 000 tons and that of the calcium cyanamide process at 100 000. The maximum production of the coal distilleries and gas factories may be reckoned at 100 000 tons of nitrogen, so the total maximum annual amount at disposal would be 500 000 tons. It must not be forgotten, that the Joint-Stock Nitrogen Co. ('Stickstoff Gesellschaft m. b. H. '), was founded in order to assist in providing nitrogenous fertilisers for agricultural purposes.

The question of supplying the raw materials necessary to the phosphatic fertiliser industry is at present a matter of the greatest difficulty. The last tons of the large pre-War reserve of mineral phosphate were already exhausted in 1916. Since that date until the middle of 1919, all the phosphates at the disposal of the industry were of inferior quality ; some coming from the Lahn deposits, and the rest from other sources. In 1913, 88 superphosphate factories used 900 000 tons of crude phosphate coming almost

(1) See R. Sept. 1921, No. 890 ; R. Nov. 1921, No. 1091. (Ed.)

exclusively from over-seas; during the War 5 factories failed and 28 were obliged to shut down owing to lack of raw material. It was not until the last six months of 1919, that it was again possible to import material of good quality, and then the price was prohibitive, for Government aid was refused in the first instance, although it was then of paramount importance. In 1920, 133 000 tons of mineral phosphate were imported, and from the beginning of 1921 both the Government and the industry have made every effort to restore the importation of raw material to its normal condition; 61 superphosphate factories have thus been able to resume work. The amount absolutely necessary for the present season is 500 000 tons. In 1919-1920, the quantities of phosphatic fertilisers supplied to agriculture compared with the amount furnished in 1913-1914 were as follows (calculated as phosphoric acid).

	1913-1914	1919-1920
Basic slag . . . . .	391 000	118 000
« Rhenania » phosphate . . . . .	—	3 700
Superphosphate . . . . .	214 000	12 000
Bone-meal . . . . .	20 000	4 300
	<b>625 000</b>	<b>138 000</b>

146 - **Manurial Value of Tobacco Waste.** — SHUTT, F. T. (Chimiste du Dominion du Canada), Report of the Minister, in *Rapport des Fermes Expérimentales du Dominion* Fiscal Year ending March 31, 1920, pp. 52. Ottawa 1921.

The waste of the by-products of tobacco factories (dust, ribs, etc.), possesses an appreciable but uncertain value as an insecticide and fertiliser. Potash and nitrogen are the chief nutritive substances it contains. When these residua are bought for use, an analysis giving the percentage of these elements should be obtained, for the poorest types, such as tobacco dust, often contain large quantities of sand. The following analyses show the differences in composition and hence in value of these waste products.

*Analyses of the Residua of Tobacco Factories.*

	Water	Ash	Loss on incineration	Insoluble residue	Phosphoric acid	Potash	Nitrogen
Dust of tobacco No 1 . . . . .	2.29 %	76.30 %	21.41 %	70.57 %	0.12 %	0.65 %	0.59 %
Dust of tobacco No 2 . . . . .	4.25	44.57	51.18	34.75	0.40	1.62	1.39
Dust of tobacco No 3 . . . . .	3.17	63.44	33.39	55.20	0.19	1.07	0.89
Stalks of cigarette tobacco . . . . .	7.87	18.53	73.60	0.55	0.63	4.49	1.04
Stalks of « Burley » . . . . .	7.03	22.56	70.41	0.38	0.92	7.69	2.89
B. E. Stalks . . . . .	7.45	22.57	69.98	0.43	0.52	7.60	1.47
Tobacco dust . . . . .	1.97	15.11	78.40	—	—	—	—

- 147 - **United States Production of Fish Scrap and Meal.** — *The American Fertiliser*, Vol. LV, No. 10, p. 92. Philadelphia, Nov. 5, 1921.

According to the *Report of the Bureau of Fisheries, Department of Commerce*, the estimated production of fish and whale scrap and meal in 1920 was 130 000 tons, a material increase over previous years. Of this amount 16 898 tons are credited to the Pacific Coast States and Alaska. On the West Coast, as a result of the heavy demand for fertiliser material, more than the usual amount of scrap was used for this purpose. In the "menhaden" industry of the Atlantic coast, the value of the Bureau's assistance in encouraging the production of fish meal has been greatly appreciated. At least 5 000 tons of meal were turned out by the producers in 1920 and considerable quantities of unground scrap are stated to have been sold to manufacturers interested in supplying stock feeds. The Bureau of Animal Industry of the Department of Agriculture has continued its hog-feeding tests, using various fish meals, and samples have been supplied to some fifteen State experiment stations with satisfactory results. The experiments in progress include the feeding of meal with high oil content, samples without removal of natural oil with additional oil added and meal made from decomposed fish. If these tests yield satisfactory results, the producers of fish meal should be reasonably assured of markets for their product as the farmers have become acquainted with its merits. The whaling companies have recently expressed an interest in the manufacture of whale meal and have provided material for a feeding test.

Considerable quantities of fish offal and waste fish incident to the New England fisheries remain unutilised, and in some cases its disposal is an item of no little expense to the producer. Lack of a regular supply makes the operation of the larger reduction plants impracticable, and the smaller plants do not appear to be wholly satisfactory for the proper reduction of some of the raw materials in greatest abundance. The Bureau appreciates the need of solving the problems in this field and hopes to be in position to take them up in the near future.

- 148 - **The Sébakh of the "Koms" or "Sébakh koufri", in Egypt.** — MOSSERI, V. M. (Vice President of the Egyptian Institute), in *Bulletin de l'Institut d'Égypte*, Vol. III, pp. 75-92, fig. 1. Cairo 1921.

"Tafla", "marog" and "sébach" from the "koms", or "sébach koufri", are nitrogen earths forming the chief natural fertilisers of Egypt. "Sébakh" from the "koms" is the most widely-used, and was employed at an earlier date than either of the others. "Sébakh" means manure and "kom" signifies heap or mound; this fertiliser is also called "sébach koufri" or simply "koufri". It is a pulverulent substance used for manuring or improving the soil and comes from the rubbish heaps that gradually accumulate near towns or villages when they have repeatedly been destroyed and rebuilt on the same site during the course of centuries. The author had the opportunity of examining over 250 "koms" of

koufri " and gives a few general ideas acquired from his investigations.

The " koufris " consist for the most part of rubbish, and they are poor in fertilising substances, but they differ according to the locality, the mound from which they are taken, or even the stratum of the same mound. The " sébakh " of the " komis " can be applied as a fertiliser or for improving the land, but in either case it nearly always has some perceptible effect upon the soil which may be favourable or unfavourable according to circumstances. It is always well, if not indispensable, to determine the composition of the " sébakh " before applying it. We may consider two ways in which " koufris " are used.

1) In the case of normal alluvial soils, " koufri " is applied as a fertiliser and should chiefly be regarded as a source of nitrogen. Its importance in this respect depends on the nitric nitrogen it contains (under the form of nitrate of sodium) which varies from traces to 35 %.

Ammoniacal nitrogen is only present in such negligible quantities that it can be disregarded without causing serious error in the calculation, and organic nitrogen can be left out of the reckoning as its nitrification is doubtful, and in any case too slow.

2) For all other soils, " koufri " may be looked upon as a source of nitrogen, phosphoric acid or potash. It is however very rarely that these substances are present in the proportions required to make a complete fertiliser, hence it is nearly always necessary to add some other fertiliser, preferably a nitrogenous. The amount of total nitrogen must here be taken into account and also the quantity of organic substances present which by their physical action, may become of considerable importance as affecting the compactness or friability of the soil. As regards the phosphoric acid (which is present to the extent of 1.3 % of phosphoric acid soluble in citrate of ammonium), and the potash (0.096 % to 2.280 %, soluble in 1 % citric acid), only the available amount in the " koufris " has to be determined and reckoned.

It must not be forgotten, that the " koufris " always contain soluble salts (common salt to the amount of 0.57 to 13.40 %). Some of these are injurious, while the others are either innocuous, or beneficial; hence it is necessary to note the nature of these salts and the proportions in which they are present. It is not always possible to know beforehand how much of these salts the " koufri " can contain without rendering it unusable, for this depends upon the nature of the soil to be manured or improved, the drainage conditions, the course of the underground water, etc. If the soil is permeable, well-drained, either naturally or artificially, and the level of the subterranean water is fairly low, the " sébakh " can safely contain rather large quantities of injurious salts. Should the contrary be the case, care must be taken to avoid applying an appreciable amount of these substances to the soil.

The author mentions the uses that can sometimes be made of the salts in the " koufris " and their value for improving more or less alkaline land.

- 149 - **Distribution of Manganese in the Organism of Higher Plants.** — BERTRAND, G., and ROSENBLATT, M., in *Comptes rendus de l'Académie des Sciences*, No. 22, pp. 1118-1120. Paris, November 28, 1921.

After having proved that manganese is of general occurrence in plants (1), the authors endeavoured to ascertain the manner in which this metal is distributed, both in the different organs of plants, especially of the higher plants, and also in the various parts of any specimen gathered at a given growth period.

The results obtained show that a large amount of manganese is present in the organs that are the seat of active metabolism in the reproductive organs, leaves, young shoots and in all the organs containing chlorophyll as well as in seeds.

- 150 - **The Manganese Content of Seeds of Dutch Origin.** — WESTER, D. II., in *Biochemische Zeitungsschrift*, Vol. CXVIII, pp. 158-163. Berlin, 1921.

There is good reason to believe that manganese plays a considerable part in plant metabolism, but though the manganese question, as it may be called, has been the subject of considerable investigation during the last 25 years, it has not yet been completely solved. Hardly anything is so far known as to the presence of manganese in the plants, animals, waters and soils of Holland; seeds have not generally been studied from this point of view and there are only a few scattered data on the subject.

The author has analysed 48 species of cleaned seeds belonging to the most widely differing families of cultivated plants: the determinations were made on the ash, which was treated twice with sulphuric acid, the persulphate colour-metric test being employed. The following amounts of manganese (in mgm. per 100 gm. of dried seeds) were thus obtained for the most typical plants: *Pinus sylvestris* (Scots Pine) 12.7 — *Phleum* (Cats'-tail Grass) 4.2 — *Alopecurus pratensis* (Fox-tail Grass) 11.6 — Oats 2.3 — *Festuca pratensis* (Meadow Fescue) 15.8 — *Poa pratensis* (Meadow-Grass) 5.3 — Italian ray-grass 4.5 — Wheat 2.8 — Barley 1.14 — Onion 1.2 — Hemp 3.45 — *Beta vulgaris* var. *crassa* (Common beet) 6.6; var. *rapa* 1.95 — Spinach 2.4 — Red Cabbage 6.5 — White Cabbage 2.45 — Turnip 2.1 — Crimson Clover 2.4 — White Clover 1.85 — Red Clover 2.5-2.7 — Lucerne 1.6 — Lupins 17.8 — Beans 1.5 — Peas 0.4 — Flax 10.2 — Celery 1.4 — Carrot 5.8 — Water-Melon 2.5 — Lettuce 2.4 — Chicory 1.7.

From the examination of these data as a whole, it is evident that seeds belonging to the most different families all contain manganese, and in most cases, in the proportion of 2 to 6 mgm per 100 gm. of dry seed. If the manganese content is estimated from the ash, it is in many cases about 50 mgm., and generally a little below 100 mgm. The seeds of few varieties of plants contain a higher proportion of manganese; lupins must however be reckoned among the exceptions, as there are 1700mgm. of this metal present in 100 gm. of ash. This figure is below the percentages given in scientific litera-

(1) See R. November 1921, No. 1097. (Ed.)



ture for the ash of certain "manganese collectors": Oak wood 3.5 % — Birch wood 10-18 % — Beech leaves 9.50 % (in the form of the manganous-manganic oxide) — Lupin leaves 8.96 % (as manganese). If the data for the species of the same genera are compared, it will be seen, that they agree fairly well (see genera *Lolium*, *Allium*, *Brassica*, *Trifolium*, *Vicia*, *Cucumis*). The similarity is however less evident in the genus *Festuca*, and in the genus *Beta* some of the most notable differences occur. If a comparison is made between the leaf data of plants which are sufficiently represented, such as the Festucaceae and Hordeaceae and the Sinapaceae, it will be found that the two first are clearly richer in manganese than the last although in the species of the same families, there are often considerable differences.

151 — **Experimental Researches on the Factors determining Resistance to Cooking in Leguminosae and on the Means employed to Remedy this Defect.** — DE DOMINICIS, A (Laboratorio di Chimica Agraria della R Scuola Superiore di Agricoltura, Portici), in *Annali della R Scuola Superiore di Agricoltura in Portici*, S. II, Vol. 16, p. 31. Portici, 1920.

From the dietetic point of view, the seeds of Leguminosae are described as being easy or difficult to cook according to the greater or less facility with which their consistency is altered by boiling in water. The causes determining this difference are not known, and no systematic attempt has been made to discover them. The question is certainly not one of hereditary character, but depends upon environmental conditions, reaction to which takes certain forms: it is therefore a peculiarity which can only be explained by these given conditions. The author has directed his attention to the causes determining this character and the results obtained are summarised as follows.

The hardness of leguminous seeds from the boiling standpoint depends upon their resistance to the action of water, whether this resistance is natural or artificially produced. The more water a seed can absorb, the more easily is it boiled, and the degree to which it is cooked depends upon the actual amount of water it has absorbed. Thus all the chemical and physical processes occurring during cooking are connected with the amount of the water taken up.

The water resistance of seeds cannot be correlated with any presupposed impermeable mineral deposits due to insoluble calcium combinations, for it can be overcome by alkalis, but not by acids, although the action of acids on the carbonate or silicate of calcium should be more energetic than that of alkalis.

Acids in fact increase this water resistance; oxalic acid has less effect however, than sulphuric and hydrochloric acid although it renders calcium compounds insoluble. This resistance cannot be attributed to the density of the integuments, because if this were lessened by the dissolving effect exerted by the alkalis upon certain given substances, acids should act in a similar manner, or else remain inactive, but in no case should they increase the impermeability of the tissues. Nor can it be regarded as connected

with the action of the ordinary ion present in hard waters upon the insoluble calcium compounds, for the seeds are equally resistant to soft waters, and the hypothesis of the existence of such mineral deposits has already been proved untenable ; moreover salts other than those of calcium and acids themselves have the same effect. For the same reasons the other hypothesis postulating the formation of insoluble calcium compounds at the moment of cooking is equally fallacious. As this water resistance is not overcome by treatment with alcohol or ether, it cannot have any connection with excessively thick deposits of wax or other fatty substances that might possibly occur on the cuticle of the seeds.

The electrolytes penetrate into seeds in proportions different from those in which they are found in solutions, the ratio being larger with acids and alkalis and smaller with salts. Their penetration into seeds is therefore not a case of pure and simple diffusion, however the properties constituting the permeability of plant membranes may be interpreted. The variations produced by the concentration of the solutions upon the amount of the electrolytes incorporated by the seeds depend on the other hand upon a fundamental law governing the adsorption by solid, or colloidal adsorbent surfaces, *e. g.* the adsorption coefficient is not constant but increases as the concentration diminishes.

The substance constituting the seeds and exercising its adsorbent power upon the electrolytes belongs to one of those colloidal forms which arise from the concentration of the dispersive medium, and have the power of restoring it in a measure corresponding with their degree of reversibility. The swelling of the seeds in the presence of water thus consists essentially in a process of imbibition, as is proved by the contraction in volume relatively to the total volume of the seeds and of the absorbed water, the development of heat at the moment of absorption, the optic phenomena accompanying it, the selective power exercised towards liquids, and especially the effect of the electrolytes. The action that may be exerted by the integuments and membranes in this connection is secondary and indirect.

The degree of the reversibility of these colloidal forms is connected with the conditions of the medium in which they have been formed and corresponds with the degree of their affinity to water. The hardness of the seeds is in strict correlation with this degree of affinity to water, although the extent to which it is influenced by the medium and the soil has yet to be determined. Experimentally however hardness is caused or increased in seeds by those special actions that intensify the non-reversibility of the gels, and should have no effect upon the above-mentioned chemical and morphological factors.

The electrolytes act by forming together with the substances of which the seeds are composed adsorption factors having a different affinity to water, or in simpler terms, having a different degree of solubility, solubility being understood in this case to mean the limit of concentration beyond which the substance in the dispersive medium is obliged to coagulate. Acids, acid salts and neutral salts act as coagulants and decrease this solubility ; alkalis and alkaline compounds act in a dispersive manner and

increase it. Thus the alkaline compounds used in cooking decrease the water resistance of the seeds and facilitate the cooking process. At the moment of boiling however the alkalis attack the protein molecule and cause it to disintegrate which leads to the formation of amino-acids and the development of ammonia, sulphuretted hydrogen and carbonic acid. Hence there is a resultant loss of available nitrogen and a danger of the introduction of deleterious substances into the system if such food is eaten. This is a factor of the greatest importance in judging seeds that resist cooking, not only from the dietetic standpoint but also the economic and industrial. It is thus seen how very pernicious are the substances (carbonate of potash and bi-carbonate of soda), now used to remedy the defects of hard seeds due to their excessive water resistance.

- 152 - **A Contribution to the Determination of the Cause of the Formation of Bacteroids in the Nodules of Leguminosae.** — BARTHEL, C. (Bacteriological Laboratory of the Central Station of Agricultural Experiments at Experimentalältet, near Stockholm), in *Annales de l'Institut Pasteur*, Vol. XXXV, No. 10, pp. 634-646 + figs. 6. Paris, October, 1921.

The experiments described in this work form part of a series of studies connected with the morphology and life-history of *Bacterium radicola* which have been carried on for several years in the Bacteriological Laboratory of the Central Station of Agricultural Experiments at Experimentalältet in conjunction with the continuous preparation of cultures of bacteria for the inoculation of the different leguminosae grown by agriculturists.

The results obtained are summarised by the author as follows:

"Our experiments have proved the accuracy of ZIPPER's statement that caffeine has the power of causing the constant formation of bacterioids in solid media. They have however also shown that this property is shared by other plant alkaloids of very different composition. Thus guanidine, pyridine and chinoline all act in the same manner as caffeine, but to a less degree. It is very probable that other alkaloids behave in a similar way, as well as other nitrogenous organic compounds such as hippuric acid.

"As these plant alkaloids always enter into the composition of Leguminosae, it appears to be most likely, that the normal formation of bacterioids in the nodules of this family depends more or less upon the presence of alkaloids in the roots."

- 153 - **Instruction and Investigation in Plant Breeding at the College of Agriculture in the Philippines.** — MENDIOLA NEMESIO, B., in *The Philippine Agriculturist*, Vol. 10, No. 3, pp. 105-107, 1 fig. Los Baños, October, 1921.

PLANT  
BREEDING

The above College of Agriculture offers 2 undergraduate courses and 1 advanced course in plant genetics. Each covers a period of six months.

*First course:* this consists of lectures and laboratory work and is modelled upon the first two undergraduate courses at Cornell University. It aims at giving students a fundamental understanding of the facts and laws underlying the phenomena of heredity and variation in their widest sense, and the relation of these phenomena to environment.

*Second course*: this deals with the methods and technique of plant-breeding with special reference to the Philippines and the Tropics.

*Third course*: elementary biometry.

The attention of the College of Agriculture has not been devoted only to instruction. Much practical work has been done in encouraging and carrying out experiments in selection and crossing, especially with rice, maize and sugar-cane which are among the most important crops of the Philippines.

- 154 - **Genetic Behaviour of the Spelt Form in Crosses between *Triticum Spelta* and *Triticum sativum*. The Possibility of obtaining Synthetic Forms of Wheat by Crosses between Two Spelts.** — LEIGHTY, C. E., and BOSHNAKIAN, S., in *Journal of Agricultural Research*, Vol. XXII, No. 7, pp. 335-364. Washington, November, 1921.

In the work described in this article 3 characters were taken into consideration: the shape of the glume, the brittleness of the rachis and the adherence of the grain. These characters are to a great extent linked.

**THE OUTER GLUME OF *Triticum sativum*.** — This is as a rule soft with a somewhat pointed apex and only occasionally weakly keeled along the entire length. About 0.5 to 1 mm. above the point of attachment there is a wrinkle or depression; the base is rather narrow and is very weakly attached to the rachis. In *T. spelta* on the other hand the glume is stiff and thick and has a very blunt apex. It is strongly keeled and has no depression above the base, which is wide and firmly attached to the rachis. Further in the spelt the rachis is brittle and the grains adhere firmly, whereas in wheat the rachis is much more tenacious and the grains are easily detached. These three characters, as stated above, are linked as if dependent on factors united in a single chromosome. The occurrence of crossovers, if it ever occurs, must be very rare.

In the 2nd and subsequent filial generations of *Spelta* × *sativum* there are many forms intermediate between the two parents.

In order to record the degree of inheritance of Spelt characters the authors have made an arbitrary scale of values ranging from 1 to 10, in which 1 represents typical spelt, and 10 typical wheat with no spelt characters.

The hybrids of the  $F_1$  are slightly intermediate in form, but much more like the spelt than the *sativum* parent. They grade from 4 to 7 and have all the characters of a spelt, except that the spikelets are somewhat more open and the glumes are less adherent to the grain. In the  $F_2$  the forms range from the typical wheat to the spelt, viz., from 1 to 10.

The frequency curve of these forms is of a special type, more individuals being as a rule found at the extremities than near the centre as is seen from Table I.

As it is impossible to distinguish the homozygous spelts from the heterozygous, 2 groups only have been made in which all the spelt and speltoid forms are included (classes 1-9 inclusive).

TABLE I. — *Number of Plants of the F<sub>2</sub> Spelta × sativum classed in 10 Categories.*

Series	Crosses	Number of individuals in class										Total
		1	2	3	4	5	6	7	8	9	10	
13255 <sup>a</sup>	<i>Spelt</i> sel. 13440 × Dale Gloria sel. 13401 . . . . .	17	10	9	5	4	1	3	1	2	21	73
13260 <sup>a</sup>	<i>Spelt</i> sel. 13438 × Turkey sel. 13389	17	13	5	5	2	3	2	—	2	14	63
13263 <sup>a</sup>	Dale Gloria sel. 13401 × <i>Spelt</i>	5	3	2	3	1	—	2	2	—	7	25
3049 <sup>a</sup>	Black Bearded <i>Spelt</i> × Early Red Chief . . . . .	19	7	5	—	3	4	3	5	6	29	81
3085 <sup>a</sup>	Black Bearded <i>Spelt</i> × Jones Longberry . . . . .	9	8	4	2	4	—	4	2	4	13	50
13124 <sup>a</sup>	<i>Vulgare</i> (C. I. 3338) × <i>Spelt</i> sel. 13437 . . . . .	9	8	4	9	7	4	3	5	7	20	76
13125 <sup>a</sup>	Crimean (C. I. 3340) sel. 13351 × <i>Spelt</i> sel. 13437 . . . . .	6	3	9	3	4	2	5	5	4	9	50

The proportions between *spelta* and *sativum* forms thus approximated to the monohybrid ratio of 3 : 1. The proportion of homozygous forms to heterozygous forms of spelt would therefore be 1 : 2 : 1, as is shown by the *F<sub>3</sub>* generation of 2 *F<sub>2</sub>* families, 13 260<sup>a</sup> and 13 255<sup>a</sup> (see Table II). TABLE II. — *Number of F<sub>2</sub> Plants from Series 13 260<sup>a</sup> and 13 255<sup>a</sup> which proved be Homozygous Spelts, Heterozygous forms and Homozygous Wheats (1 : 2 : 1) when tested in the F<sub>3</sub> Generation (1 : 2 : 1).*

Nature of data	13260 <sup>a</sup> <i>Spelt</i> × Turkey				13255 <sup>a</sup> Dale Gloria × Turkey			
	Homozygous <i>Spelts</i>	Heterozygous	Homozygous <i>Wheats</i>	Total	Homozygous <i>Spelts</i>	Heterozygous	Homozygous <i>Wheats</i>	Total
Obtained . .	8	13	9	30	7	14	12	33
Calculated. .	7.5	15.0	7.5	—	8.2	16.5	8.2	—
Deviation. .	0.5	2.0	1.5	—	1.2	2.5	3.8	—

The ratio 3 : 1 does not always occur. In the 2 families 13 126<sup>a</sup> (Giant Square head × spelt) and 3019<sup>a</sup> (Spelt × Salt Lake Club), for instance, the wheat types were very low (See Table III); in fact the proportion between the spelt forms and the wheat forms is better represented by the ratio 15 : 1 (See Table III).

On examining the *F<sub>3</sub>* generation of 27 *F<sub>2</sub>* plants, it was found, that 12 of these had produced only spelts, 2 plants yielded only *sativum* types, and the remaining 13 produced progeny of mixed forms.

TABLE III. — Degree of Spelting and Proportions of Spelts and Wheats Obtained in the  $F_2$  Generations of *Spelta*  $\times$  *sativum* Crosses which did not segregate in the 3 : 1 Ratio.

Series	Degree of spelting in class										Total	Number of plants				Deviation	Probable error
	1	2	3	4	5	6	7	8	9	10		Obtained		Calculated			
												Spelta	Sativum	Spelta	Sativum		
I326*	12	7	7	6	9	8	3	6	12	4	74	70	4	69.4	4.6	0.6	1.49
3019*	27	15	9	7	3	5	2	5	8	2	83	81	2	77.8	5.2	3.2	1.49

We thus have the proportion, homozygous *Spelta* 7 : heterozygous form 8 : homozygous *sativum* 1, as it should be according to the proposed 15 : 1 ratio.

Assuming that the spelt parent in this particular cross carries two spelt factors  $S_2$  and  $S_1$ , the two first generations will consist of the following genotypic forms :

$P_1$ (Giant Squarehead)	$S_1S_1S_2S_2$	$\times$	$S_1S_1S_2S_2$	(Winter spelt)
<i>T. sativum</i>				<i>T. Spelta</i>
$F_1$ . . . . .	$S_1S_1S_2S_2$			
	(Speltoid)			
$F_2$ (1)	$S_1S_1S_2S_2$	(1)	$S_1S_1S_2S_2$	(4) $S_1S_1S_1S_2$
		(2)	$S_1S_1S_2S_2$	(2) $S_2S_1S_2S_2$
		(1)	$S_1S_1S_1S_2$	(2) $S_1S_1S_2S_2$
		(2)	$S_1S_1S_2S_2$	
		(1)	$S_1S_1S_2S_2$	
Total: 1 <i>T. sativum</i>		15 <i>Spelta</i>		

In the  $F_3$  the theoretical behaviour of each of the  $F_2$  plants would be as follows :

Group	$F_3$ Genotypes	Phenotypes of the $F_2$ and their Behaviour in the $F_3$
A	(1) $S_1S_1S_2S_2$	1 <i>sativum</i> will yield <i>sativum</i> only
B	(1) $S_1S_1S_2S_2$	
	(2) $S_1S_1S_2S_2$	7 <i>Spelta</i> will yield <i>Spelta</i> only
	(2) $S_1S_1S_2S_2$	
	(2) $S_1S_1S_2S_2$	
	(1) $S_1S_1S_2S_2$	
C	(4) $S_1S_1S_2S_2$	4 <i>Spelta</i> will segregate in $F_3$ into <i>Spelta</i> : <i>sativum</i> in the ratio 15 : 1
D	(2) $S_1S_1S_2S_2$	4 <i>spelta</i> will segregate in the ratio 3 : 1.
	(2) $S_1S_1S_2S_2$	
		8 unstable forms

When the  $F_3$  plants were examined a close approximation was found to the above-mentioned theoretical ratios, even as regards the genotypes which segregated in the 15 : 1, and the 3 : 1 ratios respectively.

In this connection it should be specially noticed that the same genotype of *Spelta*, when crossed with different varieties of *sativum*, can give two types of segregation 15 : 1 and 3 : 1. The authors try to account for this phenomenon by assuming that the spelt parent carried 2 spelt factors  $S_1$  and  $S_2$  and that some of the wheats used in the crosses carried an inhibiting factor  $I$ . In the presence of the latter factor, the ratio would be about 3 : 1, in its absence, the ratio would be 15 : 1.

Further the existence of determinants (modifiers) accentuating or attenuating the spelt characters has been clearly shown by the authors in the course of this work, thus explaining why heterozygous spelts of the  $S_8$  type can produce very different frequency curves. Thus for instance plant 13 260<sup>a</sup>-3 produced individuals mainly of classes 8 to 9, while plant 13 260<sup>a</sup>-6 produced its spelts in classes 1 and 2 only; in the first case, there was a genetic factor attenuating the spelt character, and in the second a factor accentuating it. The presence of these factors, as may be readily understood, alters the Mendelian ratios between the *Spelta* and *sativa* forms and the combined effect of the factors accentuating and attenuating the *Spelta* character can produce some very complicated segregations.

PRODUCTION OF SYNTHETIC WHEATS BY CROSSING TWO SPELTS AND OF SYNTHETIC SPELTS BY CROSSING TWO WHEATS. — The authors have frequently obtained synthetic spelts in interspecific crosses in wheat. No indication has been observed as to the possibilities of producing true wheats in crosses between two different non-wheat cereals. It is theoretically possible, however, that such forms will be produced in crosses between certain kinds of spelts, as will be seen from the results of one of the experiments discussed in this paper. In the cross 13 126<sup>a</sup> it was shown by the authors that 2 spelt factors  $S_1$  and  $S_2$  were involved and that there were present in the  $F_2$  5 genotypic forms namely:

$$S_1S_1S_2S_2 - S_1s_1S_2S_2 - S_1S_1S_2s_2 - S_1s_1S_2s_2 - s_1s_1S_2S_2$$

As long as the forms are allowed to be selfed, as they are in nature, no *sativum* forms will ever appear, but in a number of crosses between these 5 forms, a certain proportion of wheat should occur in the following manner:

- 1) Crosses producing no wheats:  $S_1S_1S_2S_2 \times$  any other genotype —  $S_1s_1S_2S_2 \times s_1s_1S_2S_2 - S_1S_1S_2s_2 \times s_1s_1S_2s_2 = S_1S_1s_2s_2$ ;
- 2) Cross where one out of every four  $F_2$  plants will produce 6  $\frac{1}{4}$  % wheats:  $S_1S_1S_2s_2 \times S_1s_1S_2S_2$ ;
- 3) Crosses where half of the  $F_1$  plants produce 6  $\frac{1}{4}$  % wheats:  $S_1S_1s_2s_2 \times S_1s_1S_2S_2 - S_1S_1S_2s_2 \times s_1s_1S_2s_2$ .
- 4) Cross where all  $F_1$  plants will produce 6  $\frac{1}{4}$  % wheats:  $S_1S_1s_2s_2 \times s_1s_1S_2S_2$ .

It is easy to understand how the wheat (*sativum*) character, being distinctly hypostatic, may be carried concealed from generation to generation

by the spelt type. How can the spelt type, which is so pronouncedly epistatic to the wheat character, be carried by a wheat without being manifested phenotypically? The explanation is simple. It was shown that modifying determinants are involved in these crosses. Common wheats occasionally carry modifiers which dilute the spelt character to the extent of grouping all the  $F_2$  spelts into class 9. If these diluting factors are reduced to a homozygous dominant condition, they can well produce forms of spelt, identical or almost identical in appearance with wheat.

From a number of wheat  $\times$  wheat crosses (where one of the parents was a rust-resistant variety of winter-wheat and the other was Preston, Marquis, or Haynes Bluestem), over 20 spelts were found among the  $F_2$  hybrid plants, though there were no spelts in the  $F_1$ , their absence being due to an inhibition in the parent plant carrying the S factor.

These observations show that common wheats may carry the spelt factor, which is, however, unable to express itself because of the presence of one or more diluting or inhibiting factors.

The production of synthetic spelts in these *sativum*  $\times$  *sativum* crosses is similar to the synthetic production of *Triticum dicoccum dicoccoides*, the "Wild Wheat" of Palestine by the *vulgare*  $\times$  *durum* cross. The wild character, consisting of a number of interdependent specific characters, is strongly dominant over both the *vulgare* and the *durum* types just as the spelt type is dominant over *sativum*, yet in both instances, the character showing strong dominance towards either of the parental forms was carried by one of the parents together with a factor inhibiting in one case the "wild" and in the other, the spelt, characters.

**155 - Variation and Correlation of Characters Among Rice Varieties Cultivated in the Philippines.** -- TORIBIO VIHAR, in *The Philippine Agriculturist*, Vol. X, No. 3, pp. 93-104, bibliography of 24 works. Los Baños, October 1921.

**OBJECT OF THE WORK.** -- The investigation of which an account is given in this paper was conducted mainly as a basis for the selection of desirable varieties and to find answers to the following questions:

- 1) Are the late-maturing varieties heavy grain yielders?
- 2) Do tall varieties produce more grains than short?
- 3) Is there any relation between the length of the leaves, the length of the panicles, and the length of the grains on the one side, and the reproductive power of the plant on the other?
- 4) What relation have the width of the leaves, and the width of the grains to the productive power of varieties of rice?
- 5) Have the number of nodes and the number of spikes in the panicle anything to do with the grain yield?
- 6) Do tall varieties mature late?
- 7) Are varieties with long leaves, long panicles and long grains late in maturing?
- 8) Have the number of nodes and the number of spikes in the panicles any relation to the length of the growth period?
- 9) Have the width of the leaves and the width of the grains any relation to the growth period?
- 10) Is it true that varieties producing much straw require more time to mature?



The work was carried on during 1919-1920 in the rice-fields of the College of Agriculture and in those belonging to the Philippine Experiment Station farm.

**MATERIALS AND METHOD.** — For the study of variation and correlation 85 varieties were used: of these 16 are upland and 69 lowland — 30 awned and 55 awnless — 7 glutinous and 78 non-glutinous — 64 white — 1 black — 4 red — 15 mixed (of which some are undoubtedly hybrids).

TABLE I. — *Growth Period and Length of Culms.*

Growth period		Length of culms	
Days	Frequency	Centimetres	Frequency
100-120	3	80.00-96.66	21
121-140	21	96.67-113.33	20
141-160	21	113.34-130.00	25
161-180	22	130.01-146.67	13
181-200	16	146.68-163.34	3
201-220	2	163.35-180.01	3
Mean = 158.24 days		Mean 98.72 cm	

For the other values, it is sufficient to give the means — length of panicles = 22.50 cm.; number of spikes per panicle = 10.73; number of nodes per panicle = 8.11; width of broadest leaves 11.17 mm. — length of longest leaves 52.48 cm.; average width of 20 grains, 3.25 mm.; average length of 20 grains, 8.33 mm.; weight of straw per plant = 10.78 gm.

After giving the biometric data, the author considers the question of the coefficient of correlation between the most important characters. He obtained the results given in Table II, from which the following conclusions may be drawn:

- 1) The longer the time varieties of rice take to mature, the more grain they will yield.
- 2) Tall varieties produce more weight of grains than short.
- 3) Long leaves, long panicles and long grains are varietal qualities indicating high yielding power. These characters are also associated with the length of [the growth period.
- 4) There is no correlation between yield and growth period on the one hand and length and width of grains on the other. There is no connection between yield, growth period and number of spikelets per panicle.
- 5) The number of nodes in the panicle is strongly associated with yield.
- 6) Varieties producing much straw are not necessarily heavy yielders, but they are generally late maturing.

Of the 19 pairs of characters studied in this investigation, 4 were included in JACOBSON's work viz. growth period and yield of grains; length of culms and yield; length of grain and growth period; width of grain and growth period. The results obtained by the author substantiate those of JACOBSON in all respects but one. Width of grains and growth period were found by JACOBSON to be negatively correlated; in the author's work they were found to have no correlation at all.

TABLE II. — *Coefficient of Correlation between the Most Important Characters.*

Yield and growth period . . . . .	0.5613 ± 0.0498
Yield and length of culm . . . . .	0.4616 ± 0.0579
Yield and length of panicle . . . . .	0.4704 ± 0.0566
Yield and number of nodes in the panicle . . . . .	0.4977 ± 0.0547
Yield and number of spikes per panicle . . . . .	0.1677 ± 0.0052
Yield and width of broadest leaves . . . . .	0.1967 ± 0.0448
Yield and length of longest leaves . . . . .	0.1547 ± 0.0554
Yield and width of grains . . . . .	0.0591 ± 0.0474
Yield and length of grains . . . . .	0.3233 ± 0.0651
Yield and weight of straw . . . . .	0.1250 ± 0.0614
Growth period and length of culm . . . . .	0.2050 ± 0.0421
Growth period and length of panicle . . . . .	0.1270 ± 0.0611
Growth period and number of nodes in panicle . . . . .	0.1094 ± 0.6640
Growth period and number of spikes per panicle . . . . .	0.0431 ± 0.0592
Growth period and width of broadest leaves . . . . .	0.2089 ± 0.0412
Growth period and length of longest leaves . . . . .	0.9042 ± 0.0132
Growth period and width of grains . . . . .	0.0602 ± 0.0467
Growth period and length of grains . . . . .	0.2971 ± 0.0856
Growth period and weight of straw . . . . .	0.5785 ± 0.0484

156 - Leaf-Tissue Production and Water Content in a Mutant Race of *Phaseolus vulgaris* as compared with the Parental Race. — HARRIS, A. J., in *The Botanical Gazette*, Vol. LXXII, No. 3, pp 151-162. Chicago, Illinois, September 1921.

The objects of these investigations were to determine to what extent seedlings which are morphologically aberrant in the race to which they belong differ also from the normal seedlings in their physiological characters, in so far as these can be measured by the capacity for the production of tissue.

The author used as material a completely fixed teratological race of *Phaseolus* having the character of possessing 4 cotyledons. The tissues of this race (especially those of the primordial leaves) were compared with the tissues of the original line.

The biometric data fall into 3 groups:

- 1) a series of weighings of primordial leaves unclassified as to their number;
- 2) a series of weighings of primordial leaves classified with respect to their number;
- 3) a series of weighings of total epicotyledonary tissue.

*Group 1.* — The total weight of primordial leaf tissue in the abnormal seedlings is compared with the total weight in the control plants irrespective of the number of primordial leaves formed by the individual plants of the tetracotyledonous race. The total number of leaves per plant was determined separately and the following figures obtained for the 4 samples: 226 = 4.07; 227 = 4.15; 228 = 4.00; 229 = 3.91. The data are given in Table I.

TABLE I. — *Mean Green Weight per Plant and per Leaf.*

No of Plants	Per plant				Per leaf			
	Abnormal	Normal	Difference	Difference in %	Abnormal	Normal	Difference	Difference in %
226	0.6991	0.7516	— 0.0525	— 6.9 %	0.1718	0.3758	— 0.2040	— 54.2 %
227	0.6972	0.7607	— 0.0635	— 8.3	0.1680	0.3804	— 0.2124	— 55.2
228	0.6323	0.7568	— 0.1245	— 16.4	0.1542	0.3784	— 0.2242	— 59.2
229	0.7012	0.6862	+ 0.0150	+ 2.1	0.1793	0.3431	— 0.1638	— 47.7

The results show, that in 3 out of 4 cases, the green weight of the 4 primordial leaves of the tetracotyledonous race is lower than that of the 2 primordial leaves of the dictyledonous strain. The percentage differences range from + 2.1 to —16.4 with a general average of —7.37. When the comparison is made on the basis of the mean weight per leaf, the primordial leaf of the abnormal seedling is found to be on the average 54.22 per cent lighter than the leaf of the normal seedling.

The percentage differences for dry weight of primordial leaves are less, varying from —1.6 to —18 % with a general average of —10.9 %. As regards the mean dry weight per leaf, the weight for tetracotyledonous plants was lower than for dicotyledons, the general average percentage difference being —55.92.

*Group 2.* — In order to make the comparative work more complete, the author made a minute examination of the relationships by considering individually the results obtained for abnormal seedlings with varying numbers of primordial leaves (2 to 7). The data show that: the difference between the total weight of primordial leaf tissue in the abnormal and the normal seedling decreases with the increase in the number of leaves in the abnormal plant, but the tetracotyledonous plants always produce a smaller total weight of leaf-tissue than the normal plants. The difference is greater when the comparison is made on the basis of dry weight. These data are summarised in Table II.

TABLE II. — *Differences in the Green Weight and Dry Weight of the Normal and the Abnormal Types.*

No of Plants	Difference of Green Weight	Difference of Dry Weight
2	— 31.55	— 32.55
3	— 20.74	— 25.54
4	— 11.97	— 16.34
5	— 8.60	— 13.78
6	— 3.10	— 7.93

*Group 3.* — The results obtained by a comparison of the total weight of tissue produced above the cotyledonary node confirm what has already

been ascertained as regards the primordial leaves alone. The green weight and the dry weight are highest in normal plants, the percentage differences ranging from -7.6 to -29.4 for the green weight, and from -10.1 to -30.5 for the dry weight.

Thus the mutant race is distinguished not merely by striking morphological differences, but by physiological differentiation as well.

**157 - Production of Varieties of Bean with Mottled Seeds.** — BLARINGHEM, L., in *Comptes rendus de l'Académie des Sciences*, Vol. 173, No. 10, pp. 666-668. Paris, October 1921.

In 1922 the author received from the Museum of Natural History 6 small, glossy, black seeds of *Vicia Faba* L. var. *pliniana*. These were sown at the Laboratory of Meudon (Seine et Oise), at the end of April, and produced 5 plants of uniform characters which bore seeds exactly similar to the sample. In the autumn of the same year, the author planted the seeds from a single plant of *V. Faba* var. *equina* taken from a crop of beans at Locon (Pas de Calais). The two lines were crossed on May 13; the pure-bred progeny when examined in 1913 and 1914 showed no variation from the original type.

The author attributes to crossing the variations described later.

The parent plants differed in many of their characters: *V. Faba equina* grows vigorously, producing 2-3 strong, grooved, hollow stems of equal length (120 cm.), 15 mm. in circumference at the base. The bunches of compact flowers give place to 3 to 6 smooth pods 10-12 cm. in length; each fruit contains 4-6 oblong seeds of average size (12 mm. × 8 mm. × 6 mm.), of a uniform light grey colour. *V. Faba pliniana* is a slender plant with one short main stem which is succeeded by late secondary shoots that are usually sterile. The stem is partially hollow, little grooved and measures 7 mm. at most round the base. It bears few flowers which grow two or three together and are succeeded by very small, pubescent pods with a slender tip. The fruits never exceed 5 cm. in length and generally contain 2 (never more than 4), black, oblong seeds of the size of a pea (6 mm. × 4 mm × 3 mm.).

The crosses were made in the hope of obtaining xenia, but no sign of this phenomenon could be discovered. The cross-fertilisation (*pliniana* × *equina*) of 3 flowers produced 2-1-0 seeds, and by the reciprocal cross (*equina* × *pliniana*) also of 3 flowers, 3-1-1 seeds were obtained. The 8 seeds were sown in March 1914 and produced plants intermediate between the parents as regards length of stem and size of flowers and fruits. The stems were numerous and leafy, perhaps owing to the care taken in replanting the seedlings. The plants were gathered in August 1914 but could not be examined until August 1918: all the pods were hairy and had a curved beak; they contained 214 well-shaped, perfectly similar seeds. Their dull brown colour was no doubt more intense than when they ripened, for it has been found that bean seeds, whether green or yellow, become darker in the course of some years. When sown the following spring, these beans produced 92 plants whose progeny were followed until 1921.

In the second generation ( $F_2$  — 1919) the segregation of the black-grey colour factors in the seeds appeared to take place regularly, since 30 *pliniana*  $\times$  *equina* seeds produced 7 hybrids with grey seeds and 23 brown or shaded seeds : 62 *equina*  $\times$  *pliniana* seeds produced 15 hybrids with grey seeds and 47 with brown seeds : the percentages of the grey recessives (23.5 and 24.3), being near the theoretical number, 25. The brown dominants were however not at all uniform, ranging from graduated shades of mottled grey to glossy black. Similarly 10 out of 47 of the *equina*  $\times$  *pliniana* hybrids were found to have a light ground mottled with yellow or brown. As a general rule the seeds borne by a single individual are alike: two plants of the  $F_2$  however produced some pods in which the black seeds were in striking contrast to mottled seeds; an instance of segregation giving rise to a mosaic which the author has not since observed.

The proportion of plants with mottled seeds was far larger in the  $F_3$  (1920). The 10  $F_2$  individuals with mottled seeds only produced seeds of this colouring; the 22 grey-seeded recessives produced 155 plants with grey seeds and 4 with mottled seeds, these individuals were no doubt the descendants of an  $F_2$  plant with seeds but slightly mottled and hence passed over in 1919. In addition, a new character that had hitherto escaped the author's notice was clearly manifested in the progeny of some of the  $F_2$  plants. This consisted in the presence of small brown dots on a grey background which were usually most numerous round the hilum and periphery of the seeds.

In the  $F_3$  (1920), the relative proportions due to segregation in the brown hybrids ( $F_2$ ) were as follows :

	grey	Seed plants		
		black	mottled	spotted
<i>pliniana</i> $\times$ <i>equina</i> (23). . .	62	45	113	6
<i>equina</i> $\times$ <i>pliniana</i> (47). . .	93	52	177	4

The 1921 ( $F_4$ ) crops confirm these results, the progeny of the grey-seeded recessives all produced grey seeds with the exception of two lines in which there was a halo of brown spots surrounding the hilum. The plants resulting from the black seeds were rather weak and somewhat infertile. Half their seeds were black, the other half consisting of grey, black, mottled and spotted seeds in the proportions found in the  $F_3$ . The spotted seeds of the  $F_3$  chiefly produced plants with similar seeds; only 10 % showed a throwback to grey or black colouring. Out of 28 plants grown from spotted seeds 13 bore spotted, 3 mottled, and 12 grey seeds.

On the other hand, a cross made at the end of June 1919 between late ( $F_2$ ), individual of *pliniana*  $\times$  *equina* and a green-seeded *Vicia Faba* (Windsor bean), produced in 1920, shaded, intermediate, but flat beans, of which the 12 descendants in 1921 were composed of 2 recessives with

green seeds, 4 plants with brown seeds and 6 with mottled. It is remarkable that here again *the proportion of mottled seeds exceeds that of the brown or grey-seeds.*

*To sum up:* crosses effected between various divergent kinds of *Vicia Faba* show that in seeds *brown is dominant to grey or green.* The *pliniana* line imparts to the hybrids (after the second generation), the *new characters of mottles or spots*, which persist in a good many of the progeny and appear even more fixed than the brown character of the parent. There are many fixed varieties of *Phaseolus* characterised by mottling, spots or shaded areas round the hilum, so no doubt similar varieties of *Vicia Faba* could also be obtained, if there were any market demand for them.

158 - **Cotton Selection: Method Adopted in Egypt by the Sultanic Agricultural Society** (1). — FREEMAN GEO. F., in *Sultanic Agricultural Society, Technical Section Bulletin* No. 3, pp. 1-16. Cairo, 1920.

The chief types of cotton, such as American Short Staple, Indian Short Staple and Sea Island, have in all probability their origin in conscious or unconscious selection from different wild species. The several varieties within these types have originated from sports, mutations or hybrids that have been grown in separate cultures or have gained ascendancy through local climatic selection.

Since however crossing takes place freely between the different types within a species, very few commercial varieties are even approximately pure. When to this is added the mechanical mixing of seeds that occurs at the ginning plants and store-houses or through volunteer cotton in the field, it is easy to realise the difficulty of the task of the cotton selector whose object is not only to discover or produce high yielding varieties of desirable quality, but also to secure and maintain uniformity in his product.

SELECTION OF ORIGINAL, MOTHER PLANTS. — a) *Material.* — At least two or three acres are planted with the best available seed of the variety to be improved in such a manner as to facilitate the observation of the individual plants.

b) *Selection Based on Vegetative Characters.* — The type that is to be the object of selection is first determined. For this purpose a set of arbitrary standards is chosen for each of the characters (shape of boll, height of plant, branches, etc.), in order to serve as a basis of comparison.

A thousand or more plants which are true to the type of the variety in all characters considered must be examined. Each plant is given a serial number and its description is written on a printed blank. That used in 1919 was as follows:

(1) See Orig. Article of W. L. BALLS, "Studies on the Cotton Plant of Egypt," in *R. Aug.* 1915, No. 1096. (Ed.)

COTTON — *Description of Selected Plant.*

Locality . . . . . Date . . . . .  
 Variety . . . . . Plant No. . . . .  
 Diameter of space occupied . . . . . dem.  
 Height . . . . . dem.  
 Habit: open — shut — dwarf — bushy.  
 Leaves: large — medium — small.  
 Vegetative Branches: Number . . . . .  
 Bolls: Size — large — medium — small.  
 Boll: Number . . . . . Shape No. . . . .

Locules	2	3	4	5

Seed Cotton: Total weight . . . . . weight per boll . . . . .  
 weight of seed . . . . . % lint . . . . .  
 weight of lint . . . . . weight of 100 seeds . . . . .  
 Lint index . . . . .  
 Notes . . . . . Length of lint . . . . .  
 Seeds per boll . . . . .

c) *Selection Based on Provisional Estimate of Lint Length and Strength.* — The length and strength of the lint are roughly estimated in the field. If the lint from apparently normal bolls is weak or too short the plant is at once rejected.

d) *Selection Based on Laboratory Studies.* — The laboratory studies are based upon the different picking of the same plant put together, and are carried out in the following order.

1) A choice is made of seeds for microscopic or physical studies: the material is divided into 10 lots, from each of which is taken at random a sound locule; the middle seed is removed, great care being taken to separate it with its own lint.

2) The cotton seed is weighed (excluding the sample of 10 reserved seeds).

3) The seed is ginned and the seed and lint are put into separate pockets of the bag.

4) The samples of lint are submitted to a cotton expert to distinguish the three classes "bad", "typical", "superior". All the samples classified as bad are discarded.

5) The lint is weighed and its % calculated.

6) The representative sample of seeds is weighed and the lint index calculated by the following formula:

$$\frac{\% \text{ lint} \times \text{weight of 100 seeds} \times 100}{\% \text{ seeds}} = \text{lint index}$$

(It is convenient to use tables previously prepared).

7) The seeds of the plants classified as "typical" or "superior" in lint characters and which have shown themselves typical in morpho-

logical characters are then studied as regards : amount and colour of the fuzz, the shape and colour of the seed etc. It is best to use for comparison type samples placed in series and referred to by number thus : fuzz color 6 ; fuzz distribution 4 ; beak 5 ; shape 8 ; seed-coat markings 3 ; seed-coat colour 5. The range of the type of the variety in each of these characters having been determined, any plant falling outside the variety type-group should be discarded.

8) The seeds of those plants which are true to the type of the variety and are classed as excellent by the expert and also show agricultural promise (earliness, good yield, etc.), are retained for planting in pedigree plant plots the following year. The ten seeds reserved from these plants are subjected to careful laboratory studies ; 1) measurements of the lint length by combing and measuring the circumference of the lint halo, in special cases, the measures of individual fibres are also taken. Breaking strength and elasticity are determined on 100 fibres from each plant — 3) the relative fibre diameter and twist are determined microscopically on 20 fibres. These characters are all recorded and kept for comparison with the offspring of the selected mother plants grown in the pedigree plant plots the following year.

**PEDIGREE PLANT PLOTS.** — *First year* : the seeds of each mother plant are sown separately in the pedigree plots. When the plants are well established they may be thinned to one plant in the hill. During the blooming season, all the fresh flowers in each of the plant plots are counted daily ; the data thus obtained shows the earliness of the strain. Throughout the growing season, each plot is studied with regard to its uniformity in vegetative types and to all characters indicative of its agricultural value, special attention being paid to : the number and position of the vegetative branches ; the number and position of the flowers ; the length and number of the nodes of the fruiting branches ; the type and quantity of the leaves ; size and shape of the bolls ; the number of locules ; and the manner of opening of the bolls.

As the plants develop and begin to bloom, all " off type " plants should be pulled up, the reason for their destruction being given in the records of the plot.

When the first bolls open, the plant plots must be examined carefully, and those having bad vegetative characters, or few bolls per plant, or shewing late development should be rejected. From each of the remaining plots a representative sample should be picked on which are recorded lint length, weight of lint per boll, lint index and seed weight. All plots below the average in these respects are at once rejected.

From the remaining plots the plants are picked separately at harvest time. The final height-number of vegetative branches ; boll-shape number ; number of bolls opening ; average weight of seed cotton per boll ; percentage of lint ; weight of 100 seeds ; lint index ; lint length and quality of lint, as judged by the expert, are recorded for each plant.

These data are then assembled to show the distribution and average value of the different vegetative characters for the plants of each plot.



These distribution curves may then be compared with the corresponding characters of the parent plants in order to ascertain the parental stocks which were able to transmit their special characters in a high degree and average to the population of their offspring.

After the completion of these studies, the most promising individual plants of the superior plots are retained for sowing in plant plots the following year.

*Second year.* — The plant plots are sown, treated and studied exactly as in the first year; all plots that do not maintain the high standard exhibited the first year are eliminated.

In order to secure pure close-fertilised seed from the most promising plots, bags are used. These were made by the author from mosquito netting and do not hinder the respiration or transpiration of the flower as is the case with bags of paper or muslin: A piece of netting 5 by 6 inches is required for each, this is folded and sown up, so as to form a bag 3 by 5 inches; at the open end is attached a piece of thin copper wire about 4 or 5 inches long which keeps the bag in position, being twisted two or three times round the pedicel. The bag may be put on as soon as the pedicel is long enough to allow the bag to be closed beneath the bracteoles.

The exact size of the bag (which varies according to the variety of cotton-plant), must be such as to allow the petals to develop normally, but not to unroll completely. The petals thus form a loose envelope enclosing and protecting the stamens and pistils so that self fertilisation is insured.

*Third year.* — The close pollinated seed from the most promising individual plants and the superior plots of the second year are again sown and studied in the same manner, all off-type or inferior plants or unsatisfactory plots being discarded. The seed of each plot remaining after this eliminating process, is collected together, and kept for planting the following year in *pedigree increase plots*.

**PEDIGREE INCREASE PLOTS.** — *First year.* — These must be carefully watched in order to eliminate all off-type or interior plants. The study of the agricultural, vegetative and lint characters is made as before, but owing to the large number of plants, a certain number only forming a representative sample, are examined. At the end of the season the less promising plots are rejected and the seed of the very best is sown in the larger pedigree increase plots of the next year.

*Second year.* — The same operations are carried out as in the first year. At the end of the season, a further selection is made whereby only the strains which have passed all the 6 elimination tests are retained. The seeds of these strains will by this time have multiplied to such an extent as to admit of planting in large scale increase fields

In short, the operations may be grouped under the following headings:

- 1) Selection of original mother plants
- 2) Pedigree plant plots: First year
- 3) Pedigree plant plots: Second year
- 4) Pedigree plant plots: Third year

- 5) Pedigree increase plots: First year
- 6) Pedigree increase plots: Second year
- 7) Pedigree fields.

The plan is thus designed to give a continuous supply of seed pure to type and never more than 6 years removed from a single selected mother plant. If artificial hybridisation becomes desirable, the  $F_2$  plants will serve as the starting point for plant selection in the same manner as has been above described for field selection. Here selection is made by keeping in mind the combination of characters desired in the new type.

**CEREALS  
AND  
PULSE CROPS**

159 — Varietal Trials with Spring Wheat in North Dakota, U. S. Comparative Grain Yields and Milling and Baking Qualities. — STOA, T. E., in *Bulletin 149, Agricultural Experiment Station, North Dakota Agricultural College*, pp. 1-55, table XXXIII, figs. 4 Aug 1921.

The average acreage cropped with wheat in North Dakota for the 10 years period 1910-19 was 7 767 500 acres, and the average acre yield during that period was 10.5 bushels.

Varietal trials have been conducted at 7 Experiment Stations in this State. The average annual precipitation at these Stations ranges from 13.77 in. at Hettinger (S. W.) to 23.62 in. at Fargo (S. E.) and the average seasonal precipitation (April to July inclusive) ranges from 8.05 inches at Hettinger and 8.12 in. at Langdon (N E) to 12.67 in. at Fargo.

GRAIN YIELDS. — Comparative data on grain yields for the two main classes of wheat, namely, common (*Triticum vulgare*) and durum (*T. durum*) are given with reference to the several Sub-stations concerned. The class and group separations employed are as follows:—

1) *T. vulgare*: Fife Group. — Red Fife, Power, Glyndon, Marquis, Ghirka Spring, Kitchener, Ruby, Red Bobs; Bluestem Group. — Haynes, Dakota; Preston Group. Preston Pioneer, Kota, Miscellaneous. Prelude, Humphack.

2) *T. durum*: Amber Durum Group. Kubanka, Arnautka, Monad, Acme, Mindum, Kahla, Peliss, Golden Ball. Red Durum Group, D. 5 (Durum No. 5), No. 58 (C. I., No. 5618).

Of the *T. vulgare*, Marquis is distinctly superior to all other commercial varieties, for the Eastern and Southern sections of the State. In the central and south-western sections, Power gave a slightly superior yield, but the difference between the two is negligible. Stem rust (*Puccinia graminis*, has been less frequent in the western than in the eastern sections.

A comparison is made between the average yields (in bushels per acre) of the best varieties of *T. vulgare* grown at each station from 1913 to 1920, for 3, 4, 5, 7 and 8-year periods respectively. Taking for example the results for the 7-year period in the S. E. and N. W. the two outstanding varieties, Marquis and Power (Fife group), gave for the 7-year period in the S. E. area (Fargo), 21.7 and 18.8 bus. per acre respectively and in the N. W. area (Williston), 27.2 and 27.9 bus. respectively. Of the Bluestem group for a similar period in the S. E. Dakota and Haynes both gave 15.5 bus. per acre and in N. W. 26.8 and 25.5 bus. respectively. Of the Preston group

the var. Preston gave for a similar period 18.5 bus. (S. E.) and 26.6 bus. (N. W.).

A similar comparison is made between the average yields for the varieties of *T. durum* grown at each station and for similar periods. For comparative purposes the 7-year period S. E. and N. W. have here been selected.

The Kubanka gave 24.7 bus. per acre (S. E.) and 28.6 bus. (N. W.). Arnautka, 20.2 bus. (S. E.) and 28.8 (N. W.). The Monad and Acme have not been grown as long. The data available for them, however, in comparison with the other varieties, are interesting and conclusive, e. g. at Fargo (S. E.) in 4 years, Monad gave a superior yield to Kubanka by 3.5 bus. per acre and at Williston (N. W.) after 3 years the superior yield amounted to 3.6 bus.

In 1913, 13 % of the wheat acreage in N. Dakota was cropped with durum wheat and in 1920 this rose to 36 %; it is estimated that in 1921, about 45 % of the acreage will be devoted to durum.

*Stem rust infection.* — Comparative estimates are given in tabular form of the percentage stem rust infection for the principal varieties named and these indicate that of the common wheats Marquis, although not resistant, being an early wheat other things being equal, is thereby helped to escape rust attack to a large extent. Other varieties such as Power, Haynes and Preston are very susceptible to rust, but the Kota var. (Preston group) appeared to be comparatively resistant. The durum wheats are apparently, taken as a whole, more resistant both to rust and also to drought. Monad and Acme show up well in this respect and D. 5 was the least susceptible of any of the varieties named.

Observations relative to the susceptibility of varieties have been made at Fargo and Dickinson over a series of years. Taking first the S. E. section for a 7-year period, the average percentage of infection is estimated as follows: (Common) Power 49.7 to 58.4, Marquis 38.3, Dakota 49.0, Preston 47.1. (Durum) Kubanka 30.1, Arnautka 34.7, Kahla 23.7, Gharinovka 26.3. For a 3-year period Nomad showed only 1.3 % infection and Acme 2.0 %; taking next the S. W. section, a 3-years average gave: (Common) Power 24.1, Red Fife 22.8, Marquis 23.2, Haynes 24.6, Preston 29.0, Pioneer 17.6; (Durum): Kubanka 10.7, Kubanka No. 8, 12.5.

Full details are given in the tables of the infection percentage for each individual year.

**MATURITY REQUIREMENTS.** — On an average for 7 years (1913-20), at Fargo (S. E.), Marquis matured in 87.8 days, Preston 88.5, Power 91, Dakota 92.5, and Kubanka 91.7. Other data are also given.

**HEIGHT OF PLANTS.** — There did not appear to be much variation in height. Taking the 2-year period (1918-20) as an example, in the Fife group, the height ranged from 37 inches Power, to 40.5 Kitchener, in the Bluestem the range was from 38.5 to 40.5, in Preston, 39.5, and for the Amber durums, 41.0 to 41.4 in. Full details are given in tabular form comparing some agronomic characters for established and promising new varieties of wheat in the S. E. and S. W. areas.

**STRAW YIELDS.** — Durum wheats in general produce longer, and thus

more straw than the common wheats. At Fargo, Kubanka has yielded more straw on an average than any of the other established varieties. Marquis did not produce as much straw as Power or Dakota, but more than Preston. All straw yields were less in the S. W. section than in the S. E., this was especially noticeable in the case of Marquis which gave exceptionally light yields. However, the low rainfall in the S. W. area has frequently been a big factor in preventing the normal development of plants. Taking the yields as a whole, with the common wheats, the Fife group gave on an average for a 6-year period, 3475 lb. (Marquis) to 3734 lb. (Power): Bluestem group, 3596 to 3974 lb; Preston 3304 lb. and with the durum wheats, 3747 and 3748 lb. for Kubanka and Arnautka respectively.

Tables are given of data with regard to the yields per acre for the various years.

**WEIGHT PER BUSHEL.** — It does not necessarily follow that a high bushel weight alone, means a high quality of wheat, or wheat of high milling and baking value. According to the appended table, the average weight per bus. in lb. varies from 51.5 to 56.9 lb. for the Fife, Bluestem and Preston groups, and amounts to 59.4 lb. for var. Prelude. For the durum wheats, the average weight is evidently higher and varies from 59.3 to 61 lb. (In both the above-mentioned cases the data here refer to the S. W. Section and a 1-year period).

**MILLING AND BAKING QUALITIES.** — In this connection observations have been made at Fargo (S. E.) since 1917 and at Dickinson (S. W.) since 1911. The data given in the present publication include the comparative yearly percentage of straight flour from the principal varieties; the amount of water the flour absorbs, or requires, to make dough of proper consistency; the volume of the loaf baked from the flour, and averages showing the rating as regards colour and texture of the loaves. Flour from Marquis is apparently superior to that from other commercial varieties for bread-making purposes. Durum wheat flour does not appear to have the strength of gluten associated with flour from common wheats. Of the commercial amber-durum varieties, Kubanka is superior to Arnautka. Monad, a variety of more recent origin, and Acme are distinctly superior to Kubanka as regards yield but its flour gives a smaller loaf. The D-5, red durum, yields well; its milling and baking qualities are, however, distinctly of inferior quality, and do not satisfy the requirements of either the bread or macaroni trade.

160 - **The Composition of Wheat Affected by Meteorological Conditions** — SHUTT, E. T. (Chemist for the Dominion of Canada), Report of the Chemist, in *Rapport des Fermes Expérimentales du Dominion*, Fiscal Year ending March 31, 1920, p. 59. Ottawa 1921.

This study which was begun in 1908, shows that climatic and seasonal conditions not only affect the wheat yield, but may also exert a powerful influence upon the protein content of the grain. Wheat from the same parent stock was sown at the various experiment farm and Stations, and careful observations and records were made of the crops obtained, and the temperature during the growth period. One sample of wheat from each

plot is analysed, and the data are incorporated in the form of tables, in the meteorological statistics.

On account of the War the analysis of the wheat samples had been interrupted since 1916, but has now been resumed and the results will be correlated with the temperature statistics, in order to see the influence of environment upon growth, composition and yield. The first results obtained by this method of research have shown that the conditions favourable to the formation of the hard kernel, rich in gluten, characterising wheat of good quality, are a relatively dry soil, and the prevalence of a relatively high temperature during the time that the grain is filling out and ripening.

161 - **Satisfactory Results obtained in Italy with a Variety of Rice from the United States.** — NOVELLI, N., in *Giornale di Riscoltura*, Vol. XI, No. 12, p. 181-183. Vercelli, December, 1921.

The "R. Stazione sperimentale di Riscoltura" of Vercelli has imported from the United States 2 varieties of rice called American 1561 and American 1600. As the grain of both is good and the varieties were said to be very productive, trial crops were grown not only at the Station itself but on several agricultural farms and by many competent farmers in various parts of Piedmont, Lombardy and Emilia.

American 1561 never ripened; while American 1600 proved similar in development and vegetative growth to the Italian variety "originario," although perhaps it produces less straw. Average height 1.45 m.; tillering average; 15-18 culms; a little more resistant to lodging than "originario" owing to its rather slender flexible stem with many vascular bundles, and its more compact panicle; ripens at the same date as "originario," or perhaps a little earlier; ears denser with an average length of 20 cm., each bearing 160-180 kernels; production generally good, being about 60 quintals of paddy per hectare (one agriculturist obtained over 70 quintals); grain similar to that of "originario," glumes very thin and lighter in colour. This variety does best on slightly clayey soil.

The author is of opinion that it is worth breeding, and the seed section of the Vercelli "Stazione di Riscoltura" has already taken the work in hand.

162 - **Gembok Beans (*Bauhinia Esculenta*) from South Africa.** — *Bulletin of the Imperial Institute*, Vol. XIX, No. 2, pp. 142-144. London, 1921.

The seeds of the leguminous plant *Bauhinia esculenta* have been examined recently at the Imperial Institute, at the request of the Chief Division of Botany, Union of South Africa. It was stated that the seeds, which are known locally as "Gembok beans" are utilised in the South-West Protectorate both for native consumption and for feeding animals, and it was desired to ascertain their precise food value and whether they contain any injurious substance.

The seeds were dark reddish-brown in colour, about  $\frac{1}{2}$  to  $\frac{5}{8}$  inches

in diameter, with woody shells, 49 %, and oily kernels 51 %, cream-coloured with a pleasant, nutty but slightly bitter flavour.

The kernels contained 4 % of moisture ; on extraction with ether the yield was 41.6 % of a golden-yellow limpid oil, equivalent to 43.3 % from moisture free kernels.

The appended Table shows the composition of the kernels, shells, entire seeds, residual meal (containing 7 % fat) compared with that of decorticated cotton-seed cake.

	<i>Bauhinia esculenta</i>				Decorticated cotton-seed cake
	Kernels	Shells	Entire seeds	Meal	
Moisture . . . . .	4.0 %	8.5 %	6.2 %	6.4 %	8.65 %
Crude protein . . . . .	32.8	2.5	18.0	52.2	40.25
Fat . . . . .	41.6	0.2	21.3	7.0	7.93
Carbohydrates (by difference). . . . .	17.2	67.2	41.6	27.4	26.06
Crude fibre . . . . .	1.3	19.8	10.4	2.1	10.16
Ash . . . . .	3.1	1.8	2.5	4.9	6.95
Nutrient ratio. . . . .	1 : 3.4	1 : 27.1	1 : 5.0	1 : 08.3	1 : 1.1
Food units . . . . .	203	74	140	175	147

The oil extracted, which has a pleasant odour and taste, possessed the following characteristics, compared with cotton seed oil (given in brackets) :—

Specific gravity 0.9211 (0.922-0.925) ; refractive index at 40° C, 1.464 ; solidifying point of fatty acids, 30.6° C (35°-38°) ; acid value 0.6 ; saponification value 190.0 (192-195) ; iodine value 95.6 % (105-115 %) ; unsaponifiable matter 0.8 % (0.8-1.8 %), volatile acids, soluble 0.3 ; insoluble 0.1.

The results show that the kernels of *B. esculenta* are rich in protein and oil, and that the oil resembles cotton-seed oil. The meal contains a high percentage of protein but a poor fibre content, and in these respects is superior to decorticated cotton-seed cake.

No injurious substance was found in the seeds, but it has not been definitely established that they are harmless : it is considered advisable therefore to carry out feeding trials before definitely recommending the beans for general use as a feed. For this purpose, the hard shells should be removed, as they are woody and of low food value.

Up to the present no information appears to be available regarding the composition of Gemshok seeds and their use as a feeding stuff, but the seeds of certain species of *Bauhinia* are stated to be employed as a feed in India.

If available in sufficient quantities, these seeds seem likely to be of distinct value both as foodstuffs and for oil extraction.

163 - **Development of Potato Tubers. Experiments Made in Colorado, U. S. A.** — CLARK, C. F. (Office of Horticultural and Pomological Investigations) in *Bulletin No. 958, United States Department of Agriculture*, pp. 1-27, figs. 10, tables 11, Bibliography of 12 works. Washington, D. C., Aug. 22, 1921.

The experiments here described were carried out at the Colorado Potato Experiment Station, Greeley, during the seasons 1916-18. A few minor observations were also made in Maine in 1919 for the purpose of verifying previous conclusions as to the time of the beginning of tuber formation. While these studies could profitably be extended to cover a longer period and include a greater number of varieties and a wider range of environmental conditions, the author considers it advisable to place on record the results obtained up the present time.

The material used for the experimental work was grown under field conditions, the cultural operations following those in general use in the locality. The minimum size of tuber saved was  $\frac{1}{2}$  inch. When a separation was made into marketable potatoes and culls, the division was by weight, the former including those equal to or exceeding 3 ounces and the culls those below this limit.

The statistical studies of tubers at one-week intervals showed that the greater part of those which grew to exceed  $\frac{1}{2}$  inch in diameter were formed at the start of tuber development. The maximum rate of growth of tubers was found to occur at the end of August or beginning of September, approximately 80 days after planting. At this time nearly  $\frac{1}{3}$  of the total period of tuber development had been completed. The differences in the sizes of the tubers in the individual hills may be attributed largely to the unequal rate of growth rather than to the differences in the age of the tubers. A small increase in the weight of tubers was found to occur after the vines had been killed by frost.

The weight of the tuber did not appear to be correlated with the length of the stolon upon which it is produced. The average data show a tendency towards a decrease in the size of the tuber on the upper stolons, though the individual plants showed considerable diversity in this respect. The greatest average weight was produced by the lowest stolons in the 2-stolon and 3-stolon groups; while in the 4-stolon group the maximum production was in the second position, with a gradual decrease in the weight in the upper stolons. Larger numbers of observations are however needed to establish the laws governing these relationships.

The number and weights of tubers per hill were found to be influenced by the size and kind of sett planted. The relative influence of whole and cut setts on tuber production using the Rural New Yorker variety of potatoes has been determined and it appears, according to the data given that a slightly larger number and with one exception a larger weight of tubers per stem was obtained when whole setts were used.

The fact that the tuber producing ability of different varieties varies considerably with respect to the number and weight of tubers per hills is brought out very clearly in the diagrams showing the number and weight of tubers per hill produced in 500 hills of Rural New Yorker (average

4.5 and 860.7 gm. respectively) and 500 hills of Pearl (average 6.9 and 944 gm. respectively). A further comparison of the behaviour of different varieties under varying treatment with respect to irrigation was made. (The varieties tested were Triumph, Early Ohio, Charles Downing, Russet, Burbank, Peachblow, Late Ohio, in addition to the two varieties above mentioned. The number of tubers per hill ranged from 3.8 in Rural New Yorker to 7.1 Charles Downing. The lowest average weights per hill were produced by the two early varieties, Triumph and Early Ohio, the highest by the late variety, Pearl. Apparently the application of water before tuber formation had begun, increased the number of tubers. Increasing the number of irrigations appears to have had little effect on the number of tubers; the weight per hill was however increased by each additional irrigation except where the applications were too frequent.

The experiments on different types of soil revealed the existence of a close relationship between the character of the soil and the number and weight of tubers. Fine sandy loams invariably gave the best results, the number of tubers per hill (Rural New Yorker var.) being 6.3 and weight of tubers per hill 1033.5 gm. (average 162.8) compared with clay loam, 4.9, 663.7 gm. (average 136.5) and heavy clay 3.0, 376.7 gm. (average 125.3) respectively.

FORAGE  
PLANTS

164 - **The Barajillo (*Meibomia Rensoni*), a Good Leguminous Forage Plant, Indigenous in Central America** (1). — RENSON, C., in *Revista de Agricultura Tropical, Órgano de la Dirección general de Agricultura e Industria, República de El Salvador*, Vol. I, No. 2, pp. 65-71, 8 figs. San Salvador, February 1, 1921.

The barajillo, which is also called "Juana larga", "vara de arco", "arquillo", etc., is a Leguminosa belonging to the group of the Hedysaræe. It has been identified by PAYNTER (of the Bureau of Plant Industry of the United States Department of Agriculture), as *Meibomia Rensoni* n. sp., and grows wild in Central America at altitudes of between 600 and 1200 m. in places that are not frequented by livestock, for horses, mules and cattle eat it with such avidity that they end in entirely destroying the plant. When left undisturbed and allowed to grow freely, *Meibomia Rensoni* forms a small tree 5 to 6 metres in height, with slender, unbranched trunk terminating in a heavy bushy crown which makes the stem bend in a bow.

The fruit is a lomentum that easily breaks across at the joints; the latter are hard and contain a single seed.

If these pieces of the lomentum are planted in ploughed land, the seeds do not germinate; this fact has been stated by many agriculturists, and was proved by the author's experiments. The small seeds must be removed from the pod without injury and, according to the author, this is best done by placing the seeds on a plate of rubber and running

(1) For *Desmodium leiocarpum* G. Don (= *Meibomia leiocarpa* = *Hedysarum l. iocarpum* Spreng = *Hedysarum erectum* Vell) as a forage plant in Cuba, see R. December, 1920, No. 1097. (Ed)



a rubber-roller over them. After the ground is ploughed, it should be harrowed and rolled; the seeds (mixed with soil) must be sown broadcast and not covered with earth. They germinate in about 12 days, and the plants grow so rapidly that in 5 months their height exceeds that of a man.

The author advises a wide growth of this excellent forage plant in Central America, for the only artificial meadows in that country are "zacatales" composed of Graminae, and the need of a forage leguminosa is all the more keenly felt, because only negative results have been obtained with the foreign species hitherto tested.

165 - **Florida Beggar Weed (*Desmodium Tortuosum*)** (1). — MUNDY, H. G., in *The Rhodesia Agricultural Journal*, Vol. XVIII, No. 3, pp. 504-505, pl. 1. Salisbury, October 1921.

For many years, Florida beggar weed (*Desmodium tortuosum*) has given excellent results on the Experiment Station at Salisbury with or without irrigation, and without any special soil treatment. During the season 1920-21 one plot of beggar weed sown in January 1920, was cut as follows:

1st cutting (Oct. 6), height 12 inches, 2nd cutting (Nov. 20), height 18 inches, 3rd cutting (Dec. 30), height 21 inches, 4th cutting (Feb. 16), height 21 inches, 5th cutting (March 20), height 18 inches, 6th cutting (June 8), height 9 inches.

Growth on the earliest cutting was hastened by irrigation (one watering in September). A second watering was given on October 10, after which the crop was entirely dependent upon rainfall. The 6th cutting yielded 1170 lb. of green fodder per acre, and since this was the shortest growth of any, it may be safely assumed that the total yield of green forage per acre for the 6 cuttings was not less than 12 000 lb.

Further reports from other districts of Rhodesia bear out the opinion already formed of this crop.

The stalks of *D. tortuosum*, as they mature, become hard and woody and it is therefore recommended to cut or graze frequently and before it becomes too mature. The seed germinated easily, and is extremely hardy when young, very few plants burning or wilting even during drought.

Although this crop cannot be reckoned as equal in quality, where lucerne cannot be grown without great difficulty, beggar weed has been shown to be the next best substitute.

166 - **Method for calculating the Production of Pastures.** — See No. 183 of this Review.

167 - **Piedmont Hemp.** — DOLCI, E., in *La France et le Marché italien, Organe de la Chambre de Commerce Italienne à Paris*, Year XXXVI, Nos. 245-247, pp. 291-293, figs. 2. Paris, July-September 1921.

Report of Prof. Ermanno DOLCI, Technical Delegate for the Industrial and Agricultural Development of Piedmont hemp.

(1) For nitrogen content of *D. tortuosum*, See R. Dec. 1917, No. 1126. (*Fd.*)

Italian hemp has long been imported into France, and the quotations of the Bologna and Naples hemp markets are given on the Stock Exchanges of Paris and Marseilles. The author does not speak of the classic varieties of Campania and Emilia but deals solely with Piedmont hemp (*Cannabis sativa* var. *excelsior*).

The seed of this variety has for many years been imported from Carmagnola into the hemp-growing regions of Anjou and Touraine, especially into the district between Saumur and Daguemère. The seeds are sown very far apart and produce large branched plants from which the fibre known as "fils du Piémont" is obtained. This variety is sown in the fields where rope-making hemp is cultivated, and its fibre is called "petit-fils du Piémont." It is this selected seed that is bought by the growers of Basse-Loire and provides the hems for spinning, known as "chanvres pour filature".

It may be said that the Piedmont hemp seed has now acquired a world-wide reputation. Its biological characters are well-known and have been the subject of careful experiment in France, Serbia, Russia and America owing to a great extent to the initiative of the "Cassa Rurale di Villanova Solaro" (Cuneo), which has its Head Office at 22 Via Balbo, Turin.

Some large French string-factories (for instance that at Mâcon) prefer the Piedmont tow to the classical product of Emilia, and also to the Neapolitan variety, for though less pliable it is not at all woody on account of the special hand-treatment it receives. The worker seizes the base of the stalk to be decorticated, removes the cortex covering the root, and breaking the stalk into two or three pieces, then detaches it from the tow, that is to say, the stalk is removed by hand from the tow, and not the tow from the stalk. The stems are from 4 to 5 metres long and their circumference at the base varies from 3 to 5 cm.; further the amount cultivated by each grower is small (for the land is much subdivided), so the work is not so laborious as would at first sight appear; for which reason, no attempt has been made to substitute more rapid mechanical work for this manual labour. The tow after being made into hanks, is sold on the markets of Carmagnola, Vigone, Carignano and Pignerola. The hemp is known by a number of new technical names. The type called "buona" at Bologna, "macerata in tiglio" at Rovigo, and "extra," in Naples is sold in Piedmont under the title of "naturale". The fibre of stalks that have been cut by hail or are insufficiently developed is called "molletto", while the product of female plants that have borne fruit, and the tow of stalks retted by the dew, pass respectively under the names of "meschiasso" and "antersecco."

During the season an average of nearly 70 tons of first quality tow is sold weekly at the above-mentioned markets. It is always sold uncombed, for the combed hemp is all taken up by a hundred domestic-rural rope factories at Carmagnola.

100 kg. of raw tow yield: 37.75 extra tow; 35 kg. ordinary tow — 16.25 kg. of residuum (roots, oakum); 11 kg. of heterogenous substances (dust).

The 16.25 kg. of residuum furnish an excellent textile fibre that can be used in rope-making. The only really waste product is the dust; this comes from the soil adhering to the roots (in Piedmont the hemp is not cut, but pulled up), or found in the retting water. The sole defects of Piedmontese hemp are its want of flexibility and the coarseness of the fibre which limit its use in rope-making.

In order to obtain a fine flexible fibre, it is only necessary however to sow the hemp more thickly instead of planting 40 to 50 seeds per square metre, or at the rate of 30 to 50 litres per hectare (300 litres per hectare in France) according to the present custom. On the other hand, broad casting has the advantage of producing much larger seeds which are greatly appreciated and are even more profitable than the tow. In 1920, they fetched 708 *lire* per quintal. The result of sowing this hemp in the Loire valley was to increase the production by about 30 %. The characters that have made it celebrated are: resistance to bad weather, immunity to certain plant parasites and luxuriant growth.

The industrial treatment of the fibre is still based on antiquated methods and a large wooden wheel turned by hand is employed. The "Cassa Rurale" of Villanova Solaro is setting up modern plants.

The conditions at Carmagnola are most suitable for a hemp-factory, for the supply of electric power is plentiful and there are abundant means of communication with the sea through Genoa, and the interior and foreign countries, via Modane and the Simplon.

168 - *The Agave and Fourcroya gigantea at Tran-Ninh Indo-China.* — MIEVILLE M. R. (Chef de la Station agricole du Tran-Ninh), in *Bulletin agricole de l'Institut Scientifique, de Saigon*, Year 3, No. 11, pp. 360-364. Saigon, November, 1921.

AGAVE. — Description of the distribution, development of the plant and extraction of fibre with reference to plants under observation at Tran-Ninh.

The leaves of 1.50 m. length weigh on an average 2.35 kg., and 90 gm. of dry fibre are obtained, i. e. a yield of 3.83%. If the fibre proves to be of superior quality there appears to be no reason why the method of extracting fibre should not be facilitated and the industry extended. The country round Tran-Ninh is peculiarly adapted to the cultivation of the agave.

*Fourcroya gigantea.* — Bulbs were imported into Indo-China from France in 1911 and proved very adaptable to the new climatic conditions etc. The first collection of leaves was made in 1919, and it was found that 100 kg. of leaves gave 2.186 kg. of washed and well dried fibre. The fibre was larger than that obtained from agave, and was very white and shining. Air drying or sun drying has been found equally effective and the process is rapid, only requiring a few hours. The "Monodéfibreuse" fibre machine is recommended owing to easy transport, etc. A new plantation was made in 1921 on a steep slope and is so far progressing satisfactorily. *F. gigantea*, can be planted with success under trees with fallen leaves. Fine specimens have also been noticed growing in thickets. at Tran-Ninh. Drought appears to have no ill effect.

Details are given of propagation, planting, arrangement of plantation (spacing, etc.), cultural operations, defibration, etc.

169 - **Giant Grasses for Paper-Making (1) in India, Africa, Australia and the West Indies.** — In *Bulletin of the Imperial Institute*, Vol. XIX, No. 2, pp. 174-189 and Vol. XIX, No. 3, pp. 271-282. London, 1921.

A summary of work already done in connection with the utilisation of several species of wild large stemmed grasses, exclusive of bamboos. Apart from the giant forms, reference is also made to certain smaller grasses when these occur in association with the giant kinds or might be employed in paper-making in conjunction with them.

INDIA. — *Ischaemum angustifolium* Hackel (= *Andropogon involutus*, Stendel) the "sabai", "baib" or "bhabar" grass of Northern and Central India. This grows to a height of 6-7 ft., and gives two abundant crops a year without irrigation. It yields 40 % or more of cellulose. According to RAITT it is one of the best and cleanest materials known for the production of the finest printing and medium quality writing paper; even the nodes do not offer any serious resistance to the action of reagents.

*Themeda gigantea*, Hackel, sub spp. *arundinacea* and *villosa*, "ulla-grasses". The larger form is most abundant in N. W. India, growing to a height of 17 ft., and estimated to yield 3.5 tons per acre per annum if cut on a 3-years rotation. RAITT gave its composition as over 50 % cellulose, 28 % pectose etc., nearly 15 % water solubles and over 6 % lignin; average length of ultimate fibres as 2.87 to 2.9 mm., classing it first among Indian savannah grasses. When tested on a commercial scale both in India and in England, it was found difficult to bleach and hardly answered expectation but it could no doubt be used advantageously for admixture.

*Phragmites Karka*, Trinius (= *P. Roxburghii*, Kunth) "nal". This grows from 9-14 ft. high, its yield being estimated by HOLE at 3.2 tons per acre per annum on a 2-years rotation. Composition is nearly 48 % cellulose, 33 % pectose, etc. 12 % water soluble and 7 % lignin, its ultimate fibres averaging 2 mm. in length; yield 39 % unbleached pulp. It is considered a first class paper-making grass.

*Saccharum* spp. — *S. arundinaceum*, Retz, apparently including *S. procerum* and *S. exaltatum* Roxburgh, is a widely distributed gregarious species, occurring throughout India up to altitudes of 4,000 ft. It takes 3-4 years to reach maturity, and should therefore be cut on a 4 to 5 years rotation. It grows 18 to 23 ft. in height and gives a yield of 14.8 tons of dry material per acre per annum; the yield is stated to be best at the flowering season. The percentage of bleached fibre from the entire plant is stated to be 36.5, the composition of the plant being 52.9 % cellulose, 9.1 % lignin, 27.5 % pectose etc. and 10.5 % water soluble matter. This is classed among the best of the Indian savannah grasses whether for use

(1) For Plants used for Paper-Making and the Utilisation of Bamboo-, See R. May 1921, No 498. (Fd.)

by itself or for admixture and its yield per acre is more than twice the amount of any other species.

*S. ciliare* Anderss. (including *S. Munja* and *S. Sara*, Roxburgh). This grows to a height of 17 ft. and under a three years rotation will give 5.6 tons of material per acre per annum and yields 40 % bleached fibre. Composition of entire plant 51.4 % cellulose, 32.6 % pectose etc., 10.7 % water soluble matter, 5.3 % lignin. The nodes are very slightly lignified and the pulp bleaches well, resembling that obtained from wheat straw.

*S. Narenga* Wallich. Occurs in the sal forests from the Sub-Himalayas to Burma, grows 18 ft. high and gives 3.5 tons per acre per annum on a 3-years rotation. It contains 48 % cellulose, 33.9 % pectose, etc., 11.3 % water soluble matter, 6.8 % lignin. It is considered of equal value to *S. ciliare*, *S. arundinaceum*, and *S. spontaneum*.

*S. spontaneum*. — Widely distributed and gregarious species, occupying thousands of acres in Assam and reaching altitudes of 6000 ft. in the Himalayas. It has vigorous underground growth and sends up culms 7-14 ft. high. Yield 7.8 tons of air-dry material per acre, or 2.9 tons per annum on a 2-years rotation; ultimate fibre 0.8 to 2.8 mm. in length; content 45.8 % cellulose, 36.2 % pectose, etc., 9.4 % water soluble material, 8.6 % lignin. The stems are apparently very satisfactory as pulp material, but the leafy heads do not bleach well. The species occupies flooded or moist areas and occurs also in S. China and in the Caroline Islands.

*S. fuscum* Roxburgh (= *Miscanthus fuscus*, Benth) 5-9 ft. high requiring a 2-years rotation; a native of moist ground in Assam, Bengal and Burma; estimated to give 2.3 tons per acre per annum, but classed by RAITT as somewhat inferior in strength.

*Erianthus Ravennae* Beauvais (= *Saccharum Ravennae* L.) "Pampas grass". Grows 17 ft. in height and is estimated to yield over 7 tons per acre but should be cut on a 3-years rotation; fitted only for use in admixture.

*Imperata arundinacea* Cyrill (1) (including *I. cylindrica* and *I. Koenigii* "lalang." Reaches altitudes of 7000 ft.; has a creeping rhizome with erect solid culms 1.3 ft. high. Var. *latifolia* 3-4 ft. high with broader leaves found in the warmer parts of the Himalayas. Under a 2-years rotation could yield 1.7 tons dry grass per acre per annum. It is used at the present time in conjunction with bamboo etc. in paper mills in Indo-China and Queensland (2) and has proved successful in the Federated Malay States.

*I. exaltata* Brongniart, grows gregariously and is resistant to drought, ultimate fibres 0.46-1.82 mm. in length; for cheaper printing papers, but poor in colour.

*Arundo Donax* L. "Spanish reed." Widely distributed in warm and wet districts grows from 5-16 ft. in height; estimated to yield over 3

(1) See R. Feb. 1917, No. 149, and R. May 1921 No. 498. (Ed.)

(2) See R. Nov. 1916, No. 1162, and R. May 1921, No. 498. (Ed.)

tons per acre per annum on a 2-years rotation. Composition nearly 43 % cellulose, 33 ½ % pectose, etc., 14 % water soluble matter and over 9 % lignin. Ultimate fibres average 1.5 mm. length. Paper produced is of fairly good quality and the plant is placed in the first class of Indian savannah grasses by RAITT and HOLE.

*Andropogon intermedius* R. Brown. (Referred to by STAFF as *Amphiphis*). Widely distributed up to 8 000 ft. in India, N. Australia, Tropical Africa and W. Indies. Grows 7 ft. high; yields about 4 tons per acre or 2 tons on a 2-years rotation; classed as 2nd class paper making material.

*Heteropogon contortus* ("spear grass") Roem and Schults (= *Andropogon contortus* L.) widely distributed throughout the plains up to 5 000 ft.; grows 3-4 ft. high and estimated to yield 1 ton per acre on a 2-years rotation. When tested by RAITT it proved too refractory to serve as a pulp-material even in admixture form.

*Pennisetum Alopecurus* ("Moya grass") Stendel. From 15 000 to 20 000 tons available annually in neighbourhood of Pench Valley, coal-field in Central Provinces; said to yield 39 % of easily bleachable pulp.

*Eragrostis cynosuroides*, Roem and Schults, "dab" grows on barren sand in N. India. Perennial growing, 5ft. in height; estimated by HOLE to yield 1 ton per acre per annum on 2-years rotation; ultimate fibres average only 0.94 mm. in length and the pulp proved weak and difficult to bleach. It is considered therefore suitable only for admixture with superior grass pulp in a proportion not exceeding 10 %.

SOUTH AFRICA. — Tambookie Grasses (1). — Reference is made to *Cymbopogon validus* Stapf (= *C. Nardus* Rendle var. *validus* = *C. marginatus* var. *validus* Stapf). *C. excavatus* Stapf (= *Andropogon Schoenanthus* L. var. *versicolor* Hackel), *C. hirtus* Stapf (= *Hyparrhenia hirta*), *C. auctus* Stapf, *C. Ruprechtii* Rendle (= *Hyparrhenia Ruprechtii* Fourn.), *Andropogon cerasiaeformis* Nees (= *Monocymbium cerasiiforme* Stapf), *A. Dregianus* (= *Hyparrhenia Dregiana* Stapf.) and *Erianthus Sorghum* Nees.

*Andropogon Buchanii* Stapf. "dek" or thatching grass has also been tested at the Imperial Institute (1).

*Trachypogon plumosus* "stek grass" Nees. — Comprises most of the forms included under *T. polymorphus* Hackel and under this name a sample was reported on by the Imperial Institute (2).

*Themeda triandra* Forsk (including African forms of *T. Forskalii* Hackel (1), *Anthistiria imberbis* Retz and *A. ciliata* Nees). Examination proved that the ultimate fibres are mostly 1.5 to 2.0 mm. long, and yield about the same quantity and quality of pulp as the "tambookie" and "dek" grasses; the nodes are, however, harder and would necessitate thorough boiling and beating.

(1) See R. Feb. 1920, No. 202. (Ed.)

(2) See R. May 1921, No. 498. (Ed.)

*Sorghum halepense* "Johnson grass".

*Andropogon hirtiflorus* Hootefel. var. *semiberbis* Stapf. (= *Schizachyrium semiberbe* Nees (1)).

*Tristachya Rehmanni* Hackel (1).

*Aristida* sp. gave pulp inferior to ordinary chemical wood pulp, but would be only profitably manufactured for local use (*Union S. Africa Industries Bull.* No. 7, 1919, p. 66).

*Panicum obscurans* Stapf, also known as *Isachne obscurans* Woodrow (1).

WEST AFRICA. — Ten different species have quite recently been received from Nigeria for a test of their suitability for paper manufacture.

1) *Imperata cylindrica* Beauv. "ekong". Chemical examination gave moisture 10.1 %; cellulose 41.3 %, ash 5.2 %. The ultimate fibres measured from 0.6 to 1.3 mm. Tests proved that the refractory part of the material consists of the hard rhizomes and that, if care is taken to exclude these in collecting the grass, a fair yield of pulp of good quality will be obtainable.

2) *Pennisetum* sp. "esun". Composition:— moisture 10.1 %, cellulose 41.6 %, ash 7.3 %.

Under drastic conditions with caustic soda, the grass furnished a pulp which broke up fairly well, bleached to a fairly satisfactory cream colour and felted well, giving a good strength of paper. The yield was however rather low.

3) *Andropogon tectorum* Schum. Composition:— moisture 10.8 %, cellulose 44.2 %, ash 4.2 %. The pulp bleached well to a pale cream colour and yielded a paper of fairly good strength.

4 and 5) *Andropogon Gayanus* Kunth. Two specimens "jinfi" and "gamba" both identified at Kew as *A. Gayanus*: "Jinfi" contained moisture 8.9 %, cellulose 50.9 %, ash 4.0 % and "gamba" moisture 8.8 %, cellulose 49.3 %, ash 3.8 %. Both gave a well disintegrated pulp giving strong good quality paper; less caustic soda was required for "jinfi".

6) *Chasmopodium Afzelii* Stapf, vel sp. nov. "sasari". Composition, moisture 8.8 %, cellulose 44.6 %, ash 6.1 %; somewhat drastic treatment with caustic soda was found necessary and resulted in a pulp with excellent felting powers giving a good white paper.

7) *Cymbopogon giganteus* Chiov. "tsauri". Composition moisture 9.1 %, cellulose 50.0 %, ash, 5.0 %. Very drastic treatment necessary; when the temperature was increased to 160° C, a satisfactory result was obtained and a paper of good strength.

8) *Hyparrhenia rufa* Stapf. "Yama". Composition: moisture 9.3 %, cellulose 40.9 %, ash 7.6 %; drastic treatment required resulting in a well disintegrated pulp of good quality and strength.

(1) See *R. Feb.* 1920, No. 202; *R. May* 1921, No. 498. (*Ed.*)

*H. rufo* Stapf. "Kitsi gujma", moisture 8.9 %; cellulose 42.0 %, ash 6.3 %; results similar to first species but requiring less drastic treatment the sample being rather thinner and less mature.

9) Mixture of *Andropogon Gayanus* Kunth, *Hypparrhenia subplumosa* Stapf. and *Trichopteryx* sp. "baya Maria". Composition: moisture 9.2 %, cellulose 40 %; ash 5.0 %. The pulp did not break up sufficiently at first beating, but after bleaching and further treatment gave a strong opaque paper of satisfactory quality and colour.

10) *Ctenium elegans* Kunth, "wuchiyan bera". Composition: moisture 8.3 %, cellulose 47.6 %, ash 3.1 %. Requiring at least a 20 % caustic soda treatment to give a pulp which after bleaching broke up well and gave a strong white paper.

EAST AND CENTRAL AFRICA. — *Pennisetum purpureum*, Schumacher (= *P. Benthamii* Stendel). "Elephant Grass" culms reach 6.10, or 20 ft. in height — in smaller form grows at an altitude of 5 000-6 000 ft. — very abundant. It has been calculated that 2 crops could be cut annually, yielding 60 tons dried grass per acre, from which 25 tons of pulp could be obtained. The favourable results obtained on a laboratory scale have been confirmed by a large-scale trial conducted at a paper mill in the United Kingdom, and the material has since been used for Government printing paper in Uganda and appears quite satisfactory.

AUSTRALIA. — *Imperata arundinacea* (See India). It may be added that it has been employed for pulping on a small scale at Cairns, Queensland (Bulletin No. 11, 1919, Commonwealth Advisory Council of Science and Industry). Its utilisation for paper-making is not considered as likely to be profitable.

*Triodia irritans* R. Brown. Tested but found unsuitable (See Bull. mentioned above).

*Spartina cynosuroides* Roth (= *S. Schreberi* J. F. Gmelin), recommended for cultivation as a paper material in Victoria. It is a native of freshwater swamps in eastern N. America.

WEST INDIES. — *Panicum molle* Schwartz (= *P. barbinode* Trinius). "Para grass". This has been employed to advantage in Trinidad in conjunction with bagasse and bamboo. It has been previously estimated by CARMODY that 30 000 tons of bagasse-pulp, worth £12 per ton, available annually in Trinidad, would be increased in value to £15 per ton by the admixture of bamboo and para grass.

*P. myuros* "camelote". Strong, but pulp only suitable for wrapping paper.

*Uniola racemiflora* Trinius (= *U. virgata* Grisebach). Stated to be useful for paper pulp although inferior to esparto.

CONCLUSIONS. — Except in the case of the Indian Savannah grasses, it has yet to be definitely ascertained how far those giant grasses taken as a whole, could withstand repeated cropping, or on what rotation this would be possible. Careful local surveys would also be necessary to determine the existence of adequate and accessible supplies to meet the demands of the mills, etc. In every case where export is concerned, it is



necessary that the grass should be converted into "half-stuff" in the country of origin, as under present conditions, the raw material would not realise a sufficiently high price in Europe to justify the cost of transport.

- 170 - **The Oil-Bearing Sunflower on the "Riviera di Ponente", Italy.** — PERSICO, W. in *Costa Azzurra Floreale-Agricola*; reprinted in *Bollettino dell'Associazione Italiana pro Fianze medicinali, aromatiche ed altre utili*, Year IV, No. 10, pp. 155-156. Milan, October 1921.

PLANTS  
YIELDING OILS,  
DYES, TANNINS  
ETC.

The author recommends that the large, one-flowered, so-called Russian variety of *Helianthus annuus* should be grown as an oleiferous plant in the Riviera di Ponente, as its product is quite equal to olive-oil. Very satisfactory trials have been made in the experiment vineyards and rose-gardens of Pietralunga, where it has been found that about 20 quintals of seed per hectare may be expected. The seeds give 15 % of oil and 80 % of sunflower-seed cake, or 3 quintals of oil and 16 quintals of cake per hectare. Without irrigation, some plants, 46 cm. in height and with heads 46 cm. in diameter, were obtained.

The seeds of the sunflower are not only used for cakes, and in a variety of other well-known ways, but also supply an excellent flour for cake-making, while the stalks furnish a silk-like fibre and an ash with a high potash content. A brilliant yellow dye is obtained from the petals, and the leaves are used instead of those of *Datura Stramonium* as a remedy for asthma (1).

- 171 - **Gemsbok Beans (*Bauhinia esculenta*) as a Source of Oil.** — See No 162 of this Review.

- 172 - **Mangrove Species valuable as a Source of Tannin, in the Sunderbans, Forest Division of Bengal (India).** — DAS, B. M. (Superintendent, Calcutta Research Tannery), in *Journal of Indian Industries and Labour*, Vol. I, Pt. 1, pp. 482-490, Tables II, Bibliography of 16 works. Calcutta, Nov. 1921.

Although the species found in the various mangrove swamps of the world resemble one another the tannin content varies greatly in different regions, e. g. the bark of *Rhizophora mucronata* is reported to have on the average 20.5 % tannin in Borneo and 30 to 40 % in the Malay States. Hence the investigation of the mangroves in one region is no criterion of their economic value elsewhere. The Government of Bengal therefore deputed J. A. PILGRIM to make a systematic investigation of the tanstuffs of a promising area, namely the Sunderbans Forest

(1) For the use of the sunflower as a forage plant, see: R. April 1919, No. 193; R. Oct. 1920, No. 1008; R. March 1921, No. 289; R. Aug. 1921, No. 819; R. October, 1921, No. 1003.

Chopped sunflower stalks steamed for 3-4 hours make a good pig-food which the animals eat readily. As forage these stalks are superior to the straw of cereals: this is shown by the following analysis made at the Versuchstation der Brandenburgischen Landwirtschafts-Kammer: Water 7.8 % — Crude protein 9.8 % — Crude fat 0.7 % — Nitrogen-free extracts 34.8 % — Crude fibre 33.8 % — Ash 13.1 % — M. KRAUSE in *Deutsche Landwirtschaftliche Presse*, Vol. XLIV, p. 684. Berlin, 1917. (Ed.)

Division on the South coast of Bengal. The main divisions of the work may be outlined thus :— *a*) general survey of the various species ; *b*) estimate of the species that predominate ; *c*) collection of the various parts of the trees with the object of ascertaining their tannin contents ; *d*) analysis ; *e*) deductions regarding suitability for the manufacture of tannin extracts or for direct use in tanneries ; *f*) small scale tanning tests with promising materials.

Reports were made on 18 varieties of which the following are the commonest in the Sunderbans :— ‘sundri’ (*Heritiera minor*), ‘goran’ (*Ceriops Roxburghiana*), ‘gengra’ (*Excoecaria agallocha*), ‘keroa’ (*Sonneratia apetala*). Good extracts can be made from several species, but the two first-mentioned, are the most common and abundant and their exploitation for this purpose may be regarded as of immediate commercial interest.

‘Pussur’ (*Carapa moluccensis*), a less abundant variety gave a valuable material ; extract made from the wood is expected to produce a tannage similar to that of quebracho extract which is largely used by tanners in Europe and America. Large scale tanning experiments with the above-mentioned promising materials are recommended.

The importance of careful collection and preservation of tanstuffs for their ultimate tannin content and colour has been proved. PILGRIM found the best method for preserving them in good condition was crushing and drying in the sun soon after collection from the leaves. The immediate crushing and drying kept the materials free from fermentation by expelling the moisture, and consequently preserving the tannin undeteriorated. In crushing, iron was as far as possible avoided and drying was done in the sun and in two cases only was artificial drying found necessary. In this way the formation of the unattractive reds through fermentation and oxidation in many tanning materials will be much reduced resulting ultimately in a better coloured tannage.

A striking illustration of badly preserved samples is given by the figures of analysis of some British East African mangroves. Well preserved samples of *Rhizophora mucronata* (1) gave 47.99 % of tannin and, badly preserved, 21.30 % only. Similarly, BLOCKEY reports some analyses of Indian mangrove barks and an interesting comparative percentage table is given for the BLOCKEY and PILGRIM analyses respectively : *Bruguiera gymnorhiza* (1) 9.7 and 31.55, *Kandella Rheedii*, 17.3 and 13.34, *R. mucronata*, 4.5-6.1 and 35.0.

In the present investigation, not only were bark, fruit, leaf and wood collected, but samples were also taken of the bark of twigs, branches and bole, of the outer husk and the inner kernel of the fruit, and of the young and mature leaves, of the branch and the bole wood.

Two main factors have been brought to bear upon the discussions regarding the suitability of the various materials analysed for extract man-

(1) See K. Sept. 1920. No. 871. (Ed.)

nufacture, namely: 1) the proportion of tannin to soluble non-tannin present in the material and; 2) the chloride content. Care was taken to calculate the yield of the extract in popular commercial forms, the expected percentages of tannin in the extracts and the quantity of material required to run an extract plant of suitable commercial size, *i. e.* with a daily capacity of 3 tons. Both in yield of extract and in percentage of tannin the following species stand out conspicuously: bole barks of *Rhizophora mucronata*, *Ceriops Roxburghiana* and *Bruguiera gymnorrhiza*.

The use of crude tanning materials is being fast supplanted by tannin extracts owing to the fact that the tanner can thus obtain tannin in concentrated form and the use of strong solutions is rendered possible which quickens the tanning process. This has given rise to a method by which leathers can be tanned in a week, whereas the process formerly took 6 months. The easy transport and consequent saving of freight are also of importance.

Besides their use for tanning, mangrove extracts are largely employed for waterproofing fishing nets and sails, and also to a large extent as a substitute for cutch (*Acacia Catechu*) in dyeing. PILGRIM discovered 2 materials very suitable for this purpose viz.; the waxy outer cortex barks of *Carapa moluccensis* and of *Bruguiera gymnorrhiza*. As the removal of this dead outer cortex scale is not likely to damage the trees, the supply of materials, especially of the former, is likely to be abundant.

As regards mixed mangrove extracts it is considered possible to make a useful tannin extract from suitable mixtures of 'babul' (*Acacia arabica*), myrabolan (*Terminalia belerica*) and 'goran' (*Ceriops candolleana*), the 3 standard tanstuffs of Bengal; by varying the proportions of the components, it would be possible to meet the requirements of different kinds of leather.<sup>4</sup>

173 - Utilisation of Serum in the Dilution of *Hevea* Latex. — DE VRIES, O., in *Bulletin Agricole de l'Institut Scientifique de Saïgon*, Year 3, No. 10, pp. 332-334, Tables 3, Saigon, Oct 1921. Reproduced from *Mededeelingen van het Centraal Rubberstation*, No 28. Buitenzorg, 1921.

RUBBER, GUM  
AND  
RESIN PLANTS

In the preparation of rubber, the serum residue after coagulation has been occasionally employed for the dilution of the latex, either from the point of view of economy as regards acetic acid or owing to the lack of fresh water. It appears from the results hitherto obtained, that serum thus used has no appreciable effect on the properties of the forthcoming rubber. This would seem evident from the data appended, comparing the resistance to abrasion, standard time for vulcanisation, slope and viscosity.

It this method of preparation is followed for several consecutive weeks, the natural accelerating action arising from the decomposition of the serum albuminoids will result in a speedier preparation of rubber. When, however, sodium bisulphite is added to the latex at regular intervals, the time taken for vulcanisation is not affected to any noticeable extent, if at all. The use of old serum tends however to encourage more rapid vulcanisation.

Apparently also with latex thus diluted, the composition of the liquid in which the rubber globules are suspended remains the same or perhaps only slightly changed, owing to the fact that to obtain the serum, the latex was coagulated with acetic acid. The following data indicate the relative effects of dilution with water and serum on the time taken for vulcanisation.

Latex diluted at 15 % with water, standard time for vulcanisation	120 min. at 7.5 %	125 min.
" " " " " serum " " " "	105 " "	110 min.
Non-diluted . . . . .	105 " "	

These results were obtained with a coagulum which was converted into crêpe 5 hrs. after coagulation.

By diluting the latex at 7.5 % rubber content with water and serum in proportions so that the serum dilution is equal to a water dilution of the latex at 15 %, the time for vulcanisation amounted to 120 min., *i. e.* the same as with latex diluted with water at 15 %. After conversion into crêpe the day following the figures were :—

Latex diluted at 15 % with water, standard time of vulcanisation	= 110 min. at 7.5 %	120 min.
" " " " with serum " " " "	= 55 " "	
Non diluted . . . . .	= 95 "	

The fact still remains unexplained that when serum is employed, the vulcanisation appears to advance more quickly. However, the results of experiments already made indicate that the time necessary for vulcanisation of rubber depends more especially on the concentration (composition) of the liquid when the coagulation takes place, *i. e.* the quantity of serum with which it is associated.

174 - Observations on the Camphor Plant (*Blumea balsamifera* D. C.) in Indo-China. -- VERNET, N. G. in *Bulletin agricole de l'Institut scientifique de Saigon*, Year 3, No. 11 pp. 315-353. Saigon, Nov. 1921.

As a result of a communication received from GARNIER (Directeur de l'Agence Economique de l'Indochine) dated Feb. 11, 1920 with reference to the possible utilisation of the Indo-Chinese camphor plant (*Blumea balsamifera*) for the extraction of borneol, specimens from various quarters have been distilled to test their possible value, according to directions given by GARNIER in conjunction with Prof. PERROT (Directeur de l'Office National des Matières premières pour la droguerie, pharmacie, distillerie et parfumerie). The Bussy apparatus used in the " Institut Scientifique de l'Indochine " for distillation has already been described (1)

The results obtained combined with records concerning the preservation of samples have made it possible to compare the borneol yields derived from leaves : 1) submitted to varying periods of preservation ; 2) distilled fresh or dried ; 3) of varying age ; 4) from districts where after collection of the leaves there has been some defect in the preparation. Unfortunately up to the present it has not been possible to study seas-

(1) See R. Oct. 1920, No. 1030. (*Fd.*)

onal influence. Apart from the data given as regards badly preserved or insufficiently dried samples, etc., the author gives a table showing all the superior yields obtained from dried leaves with a note that their condition of dryness appeared satisfactory, the leaves not having fermented and showing no sign of mould. Taking the samples from Quang-Khe as an example, the data are as follows: weight of leaves distilled, 41 kg.; crude camphor obtained 0.51 kg.; yield per 1000 12.44 kg.; essences, trace. Comparing these figures with those for samples from various other districts the yield of crude camphor, varies from 7 to 12 per 1000.

The relation between the yield of camphor and of essence is worth noting. The fact that certain samples with a high camphor content showed only traces of essential oil may be attributed either to the transformation of the latter into camphor by oxidation in air or to speedy evaporation of the essence during dessication. This is still an open question, but as regards industrial value there does not appear to be any advantage in undertaking the laborious operation of dessication of the leaves before proceeding to distillation, and it is advisable to proceed directly with the treatment of the green leaf immediately after plucking.

The question has arisen as to the economic value of the distillation process. MAGEN "Chef du Service Agricole de Cochinchine", forwarded to Giaray a request for an estimate of the costs of collection of leaves from an area covered with a very thickly growing mass of *B. balsamifera* and the information supplied to him by ANGLÈS, "Chef de la Station de Giaray", is as follows: 500 plants of *Blumea*, age from 1 to 2 years give 225 kg. of leaves, and the cost of collection amounts to \$6.00 (estimated yield per plant is 0.45 kg.). Estimated cost of collection of 1000 kg. is \$24.00.

Until a more advantageous arrangement is made both as regards collection cost and a regular sale it seems doubtful whether the utilisation of *B. balsamifera* can be considered industrially profitable in Indo-China.

#### 175 - Characters and Use of Cuica Resin derived from *Cercidium spinosum*. -

*Bulletin of the Imperial Institute*, Vol. XIX, No. 2, pp 144-145. London 1921.

In a previous account of the examination of "cuica" or "quika" resin (1) which is derived from *Cercidium spinosum* Tulasne, a small tree, native to Columbia, it was stated that the material was inferior to other resins for the preparation of spirit, turpentine or oil varnishes, but in order that conclusive trials might be made, a further supply was obtained from Columbia last year. The new sample examined was similar to the earlier sample, but contained a rather larger proportion of bark. The percentage composition of the present sample on analysis at the Imperial Institute, London, was found to be as follows: moisture 2.1, matter insoluble in boiling alcohol, 15.3 (consisting chiefly of bark), matter soluble in boiling alcohol (resin), 82.6, ash 2.1.

(1) See R. May 1921, No. 501. (Ed.)

After practical experiments at a varnish manufacturers; "cuica" was found to be not very satisfactory as a resin in the preparation of oil varnishes and it is considered that the only possible use to which it could be put would be in the preparation of tin lacquers in which benzol or similar solvents could be used. It appears doubtful whether it could be sold remuneratively in competition with better materials already available and it would have to be offered at a price between those for Manila resin and common resin (about £1 to £2 per cwt, May 1921), the value depending on the purity of the material.

**STIMULANT,  
AROMATIC,  
NARCOTIC AND  
MEDICINAL  
PLANTS**

- 176 - Notes on the Cultivation and Commercial Value of *Carica Papaya* in Ceylon and Future Possibilities in India: Investigations on the Composition of the Fruit. — I. SANYAL, PHANI BHUSAN, The Plant *Carica Papaya* and its Enzyme, in *The Agricultural Journal of India*, Vol. XVI, Pt. V, [pp. 496-507. Calcutta, [Nov. 1921. — II. CHALOT, C, and BONNY, R, Composition de la Papaye, in *L'Aeronomie Coloniale*, Year 6, No. 46, pp. 130-135. Paris, Oct. 1921

I. Information is given regarding the trade of Ceylon in the economy product, papaya, which up till now has been the chief source of supply to other countries, but it appears that at present the demand for unadulterated papain is in excess of the supply. From a rough estimate given as follows of the selling price and also the cost of production of papain, it appears that the papain industry in India would also be quite lucrative.

	Per acre	
	Minimum 400 trees (Bombay Pres.) lb.	Maximum 500 trees lb.
Papain at $\frac{1}{2}$ lb. per tree (in Ceylon the yield being $\frac{1}{2}$ to $\frac{3}{4}$ lb. per tree)	200	250
Selling price at Rs. 5 to 6 per lb. . . . .	Rs. 1000	Rs. 1500
Deducting the cost of cultivation, collection and preparation etc.	200	250
Profit from papain . . . . .	800	1250
Profit from fruit left after extraction . . . . .	200	250
Net profit . . . . .	1000	1500

The activity index (i. e. the quantity of protein digested per unit weight of papain in a fixed time and at a particular temperature) has been found to vary much in the trade samples. As estimated by the PRATT method on milk protein (*Philippine Journal of Science* (1915) 10, pp. 1-33), commercial specimens from Ceylon gave the following numbers: 0.1, 5.6, 9.7.

*Cultivation.* — Although usually propagated by seeds, recently asexual propagation (grafting) has been tried with some success in Amer-

ica (1) (*U. S. Dept. of Agr. Bureau of Plant Industry, Circular 119*) and also in Lucknow (India) (*Dept. of Land Records and Agriculture U. P. of Agra and Oudh. Bull.*). It has been claimed that trees so propagated fruit more quickly than seedlings. The latter are ready for transplanting about 1 month after germination and can be planted in their permanent positions at 10 ft. intervals a month later.

The following fertiliser has been successfully tried at the Hawaii Experiment Station (2) for young plants (in lb.):— superphosphate 800 + sulphate of potash 315 + nitrate of soda 250 + sulphate of ammonia 190 + black sand (volcanic ash), 445. This has been applied at the rate of 1 lb. per tree at planting time. In the Bombay Presidency, house or farmyard manure at the rate of 20 cartloads per acre has been used with success. It has also been found that 2 ploughings and 2 harrowings just before sowing improved the growth of the plants.

It is interesting to note with reference to the production of both male and female flowers that on many occasions male flowering plants have been found to change their sex *e. g.* a tree 1 ½ years old had produced only staminate flowers (1); the top of the tree was cut off and leaves plucked. After some months new branches appeared and these bore fruit.

I. II. COMPOSITION AND COMMERCIAL VALUE. — The general composition of the papaya fruit is shown by the following percentage analysis, water 90.75, protein 0.80, fat 0.10, nitrogen free extract 6.32, fibre 1.09, ash 0.94. The most important property from a biochemical point of view is the proteolytic power possessed by the latex of the fruit (2). In order to make a comparison between the analyses of several different seedling strains, the authors (II) have included a reproduction of records kept at the Hawaii Experiment Station, relative to strains coming from Trinidad, South Africa, Honolulu, Barbados, Tahiti and Panama. Apparently the sugar content consists principally of invert sugar, only traces of sucrose being present.

These records also include data with regard to the composition at various stages of maturity. The insoluble solids are about 3 % in the green and decrease to about 1 % in the ripe fruits. The ash, acid and protein occur in small quantities and are quite constant. The sugars in the green fruit do not exceed 2 % but increase rapidly as the fruit increases in size and ripens.

(1) In the *Manual of Tropical and Sub-Tropical Fruits* (Wilson POPEOE), Chap. V'I, p. 234 (Papaya and its Relatives), it is stated that "later experience has shown that when propagated by this means in Florida, a given variety degenerates rapidly, and in the third and fourth generation from the parent seedling, the grafted plants make very little growth and their fruits are small and practically worthless. The explanation of this behaviour has not been found, nor is it known whether it will occur in other regions but its effect in Florida has been to do away with grafting and cause all growers to return to seed propagation. (*Ed.*)

(2) For Papaya in Hawaii See R July 1914, No. 613. (*Ed.*)

**PREPARATION OF CRUDE PAPAIN.** — A sample of papain prepared at Pusa (I) was found to contain the following percentages; total nitrogen 9.10, albuminoid nitrogen 2.44, ammoniacal nitrogen 0.59, ash 6.92, lime 1.21, magnesia 2.19, potash 0.69, soda 0.60, phosphoric acid 0.96.

A medium sized fruit will furnish at least 100 gm. of latex. The author (I) describes the various methods of purification of crude papain and adds details of the determination of proteolytic activity of the papain purified in these various ways at Pusa, the figures showing that the samples thus prepared, compare favourably with the best marketed products from the Philippines, Mexico or Ceylon. He draws attention to certain points worthy of attention in the preparation process and in order to ascertain the effect of temperature and reaction of the medium on the rate of action of papain, tests were made with results indicating that the sample acted best in neutral and very slightly acid solution. A small quantity of alkali was found to decrease the activity considerably, but it did not totally stop it, as would be the case with pepsin. The fact that the quantity of coagulable protein digested was so great at temperatures as high as 80, 90 and 95° C no doubt explains why a few pieces of unripe papaya will very quickly soften almost boiling water.

#### FRUIT GROWING

177 — **Banana-Growing in Porto Rico.** — GONZÁLES RÍOS P. in *Gobierno de Puerto Rico, Departamento de Agricultura y Trabajo. Estación Experimental Insular, Río Piedras. P. R. Boletín* No. 25, 30 pp., figs. 10. San Juan, 1920.

The chief banana growing countries are Central America and the Antilles; the largest quantities being produced at Costa-Rica and in Jamaica. The banana is the favourite fruit at Costa-Rica, the green varieties forming the principal food of the poorer classes. The whole crop is consumed in the country, and until quite lately it not infrequently happened that St. Domingo bananas were offered for sale in some of the markets of the island.

At Porto-Rico, the banana has never been systematically and scientifically cultivated and the tree may be said to grow wild.

Most of the districts where coffee is cultivated, such as Yanco, Lares, Adjuntas, Utuado, San Sebastián, Maricao, etc., are great banana-growing centres, for the tree affords an excellent shade to the coffee plantations, and the workers receive most of their wages in the form of the fruits.

Banana-growing in Porto-Rico has a great future before it.

The main object of the Bulletin analysed is to classify the different varieties of banana trees found in the island, and to describe some of the cultural experiments which have been made. It also gives an account of the cultural methods now employed and those which should be adopted.

The following varieties growing in Porto Rico are described by the

(1) See *R* Feb 1916, No 182. (Ed.)

(2) See *R*. July 1915, No. 820 (Ed.)



author: "Guineos dátiles" (*Musa sapientium*) — guineos enanos (*M. Cavendishii*) — chamaluco (*M. normalis*), the fruits of which are used for cooking while still green — "guineo gigante", or "guaranes" (*M. sapientium*) with large bunches; this is the variety specially grown in Jamaica, and supplies most of the bananas exported to the United States, plátano común, plátano enano, plátano congo, plátano harton, plátano dominico, plátano maricongo, all varieties of *M. normalis*; the three latter are so similar to "plátano común" (having only a few more fruits in the bunch), that they may be regarded as one variety — "guineo morado" (*M. sapientium*) — "guineo gigante enano", viz. a dwarf tree with very large fruits (*M. sapientium*), one of the best varieties for cultivation.

The disease known as "el mal del plátano", which is due to *Fusarium cubense*, is a serious danger to the banana-tree in Porto-Rico. At first the trees grow vigorously, but when the fruiting season approaches, the petioles begin to turn yellow and the leaf-blades assume a chocolate colour and fold in two throughout their length.

Any fruit-bunches produced are usually badly developed, or if owing to the great fertility of the soil, bananas are obtained the first year, no fruit is borne afterwards. The pathogenetic agent lives as a saprophyte in the soil. It is propagated by the seeds or by mechanical distribution. Since it lives in the interior of the tissues, fungicides are of little avail, and recourse must be had to preventive measures.

Few insects attack the banana in Porto Rico and cause no serious injury. The author mentions the "caculo achocolatado" (*Phyllophaga* sp.) which eats the leaves of the banana and of several other plants, and the "vaquita" (*Diaprepes* sp.).

In conclusion he describes the preparation of banana meal, known also as "bananina" or "nusarina", and gives various simple recipes for its use.

## LIVE STOCK AND BREEDING.

178 — The Effic. of Chloropicrin Fumes on *Argas reflexus*. — REMY, M. P., in *Comptes rendus de l'Académie des Sciences*, Vol. 172 (Meeting of June 20), No. 27 pp. 1619-1624. Paris, June 1921.

HYGIENE

*Argas reflexus* is a parasite causing great mortality in pigeon lofts and sometimes producing serious affections in man. The destruction of this pest is a very difficult matter, for it can remain without food for several years and none of the insecticides hitherto used are absolutely certain in their effects. This does not apply however to the fumes of chloropicrin which have proved to be highly toxic in the case of other insects also (1). The author has found that if *A. reflexus* is exposed to these fumes paralysis ensues which always ends in death. No experiments

(1) See R. Jan 1920. No 58. (Ed.)

on a large scale have been made but doses of 20 to 30 gm. per cubic metre seem the most effective. The fumes should be allowed to act all day and if masks are worn there is no danger in the operation. As the hatching period lasts from 8 to 15 days, a second treatment 1 month after the first will be necessary, in order to destroy the mites that have hatched out last.

179 - **The Autopyotherapeutic Treatment of Strangles.** — MONBET, M. (Vétérinaire-major), in *Revue Vétérinaire*, Vol. LXXIII, Third Series, Vol. II, pp. 338-344. Toulouse, June 1921.

The excellent results obtained by the pyotherapeutic treatment of contagious lymphangitis in the horse suggested to the author that the same methods might be applicable to strangles which is the chief pyogenic equine disease.

The technique used was a series of autopyotherapeutic injections. The pyovaccine was prepared according to the method described by BELIN, in the *Bulletin de la Société centrale de Médecine vétérinaire*, of Feb. 28, 1919, p. 73.

Injections were made into the muscles of the central region of the collar at equal distance from the mastoid-humeral, the upper edge of the collar, and the front edge of the shoulder.

This region is first shaven and then disinfected by painting with tincture of iodine.

The injection is made by means of the short needle used for intra-dermo-palpebral maleinage attached to a 5 or 10 cc. Pravaz syringe. The amounts used are as follows: 1) four first doses increasing from 1 cc. — 1.5 cc — 2 cc — 2.5 cc. on the first four days — 2) Two doses of 2.5 cc. on the fifth and sixth days.

The experiments made on 4 mares showed that: strangles can be cured by autopyotherapeutics; this treatment, at all events if the technique described in this work is adopted, is perfectly safe; it seems to check the development of specific inflamed adenoids, but has little perceptible effect upon the course of catarrhal local affections.

180 - **Vaccination of Cattle against Anaplasmosis; the Results of Inoculating High-Class Breeding Animals with Sheep and Goats' Blood infected by Repeated Transmission.** — LIGNIÈRES, J., in *Bulletin de la Société de Pathologie Exotique*, Vol. XIV, No. 8, pp. 459-460. Paris, October 12, 1921

The author has been able to prove from his experiments in the vaccination of cattle against anaplasmosis, that by using the blood of sheep or goats which has been infected by repeated transmission, strong reactions requiring special treatment, but not necessarily terminating fatally, are produced in pure-blood breeding stock (1).

The natural resistance to *Anaplasma argentinum* conferred upon these cattle by such vaccination is a very important point and has been

(1) See R. April 1920, No. 438. (Ed.)

the subject of careful study on the part of the author. The results hitherto obtained have been very encouraging. In every case the greatest immunity to natural anaplasmosis has been shown by the youngest animals that have been repeatedly inoculated.

An actual proof of the value of such treatment is given by the experience of a large Argentina stock breeder who was willing to expend considerable sums on supplying breeding-cattle for districts infested with piroplasmosis and anaplasmosis. He immunised 200 of these animals in 2 series, adopting the method employed by the author. Six months later he sent for a cow from the infected region and inoculated with the blood of this animal 6 vaccinated cattle and 2 which had not been vaccinated. The latter became seriously ill and one died. Of the 6 vaccinated individuals, 4 bore the treatment very well, in 2 there was a reaction which in one case terminated fatally. Laboratory examination revealed the presence of *Anaplasma argentinum* in the blood corpuscles of all the diseased animals.

This searching test would seem to prove without any possibility of error that the method employed is thoroughly effective.

181 - "Ghedda", or Hemorrhagic Septicemia of the Dromedary. — DONATIEN, A., in *Archives des Instituts Pasteur de l'Afrique du Nord*. Vol. I, No. 3, pp. 242-249. Tunis, 1921.

This is an epizootic disease which must be very wide-spread, being known to the Arabs of numerous tribes as "Ghedda", or under some almost identical name.

From its symptoms and the lesions produced, "ghedda" may be regarded as nearly allied to the forms of hemorrhagic septicemia attacking horses, cattle, sheep, dogs, etc. The probability of this kinship is strengthened by the difficulty or impossibility of transmitting these manifestly contagious diseases by means of inoculation with the humours or organs of infected animals.

Although in other species certain microorganisms, especially *Pasteurella*, have been found to play at least a secondary part, no parasites of this kind have ever been discovered in the case of the camel.

Thus the primary and secondary virus of "ghedda" are still unknown.

182 - Note on the Natural Spirillosis of the Rabbit (*Spirochaeta cuniculi*). — I. LEVADITI, G. MARIE, A., and NICOLAUS, S., Virulence pour l'homme de la spirillose spontanée du lapin, in *Comptes rendus de l'Académie des Sciences*, Vol. 172, No. 34, (June 13, 1921), pp. 1542-1543, bibliography of 5 works, Paris, 1921. — II. RUPPERT, F. (Mitglied des Staats-instituts für Experimentelle Therapie), Über eine durch *Spirochaeta cuniculi* hervorgerufene kontagiöse Geschlechts-krankheit der Kaninchen (Kaninchen Spirochaetose), in *Berliner Tierärztliche Wochenschrift*, Year XXXV11, No. 42, pp. 493-496, 4 figs. bibliography of 18 works. Berlin, October 20, 1921.

I. — The authors have studied from the microbiological, histological and pathogenetic standpoints a spirochaete disease of the rabbit characterised by scabrous papulae occurring on the reproductive organs and nostrils.

This malady has been recorded in Austria, Germany and Holland. It is produced by a spirochaete with much morphological resemblance to *Treponema pallidum*.

The histological researches and the data connected with this disease have been dealt with in a paper written in collaboration with ISAÏCU (1) and brought before the "Société de Biologie". Experiments have proved that *Spirochaeta cuniculi* is not pathogenetic to man.

II. — Detailed information respecting: the history and etiology of rabbit spirillosis; the morphology of the pathogenetic agent; the results of natural and artificial infection; the symptoms, pathological anatomy and microscopic evidence of the disease. As regards treatment, the author states that good results have been obtained by doses of 0.04 gm. to 0.06 gm. of "Silbersalvarsannatrium" per kg. of live weight.

Rabbits after having been cured, can again contract the disease, which proves they have not acquired immunity.

#### FEEDS AND FEEDING

183 — A Calculation of the Amount of Food necessary for Stock, especially when Grazing, per 500 kg. of Live Weight. HOLDEFLEISS, P., in *Deutsche Landwirtschaftliche Presse*, Year XLVIII, No. 94, p. 60; Berlin, November 1921

In order to allow a uniform comparison of the amount of food required by stock, the calculation is based on a live-weight of 500 or 1000 kg.

KÖHN and KELLNER's rationing tables are also based on 500 kg. of live-weight. It is however well-known that 500 kg. of live-weight have a significance differing with the size of the animals considered. In practical rationing these conditions are taken into account, maximum or super-maximum amounts being given to small animals, and minimum quantities to large animals. It would be better to use determined numerical proportions; simple coefficients or connection factors could easily be employed in reckoning the ordinary rations. This method is particularly useful in calculating the production of pastures, especially when the animals belong to different species and are of varying sizes.

According to RUBNER and KELLNER the amount of food required is in more direct relation to the body-surface than to the live-weight,

In order to obtain numerical proportions that can be used, the author has devised the following formula where  $a$  represents the live-weight in pounds of 500 grams,  $Fu a$  represents the amount of food required per head, and 1 the amount necessary for 1000 pounds of live-weight:

$$1 : Fu a = \sqrt[3]{\frac{1000^3}{a^3}} : \sqrt[3]{a^3}$$

The cube-root of the live-weight is unity: its square is the ratio

(1) LEVADITI, M. and ISAÏCU, in *Comptes rendus de la Société de Biologie*, Meeting of June 11, 1921.

with the body-surface. The amount of food required for the live-weight is therefore :

$$Fu a = \frac{\sqrt[3]{a^2} \times 1}{\sqrt[3]{1000^2}}$$

For 1000 pounds of live-weight, the formula is as follows :

$$Fu \times 1000 = \frac{\sqrt[3]{a^2}}{\sqrt[3]{1000^2}} \times \frac{1000}{a} = \frac{10}{\sqrt[3]{a}} = f$$

By giving  $a$  increasing values, a decreasing logarithmic series is obtained for the values of  $f$ .

TABLE I. — *Correction Coefficients  
for the different Values of Live-Weight.*

$a$ Live-Weight in kg.	$f$ Correction Coefficient	$a$ Live-Weight in kg.	$f$ Correction Coefficient
0.5	10.00	200	1.36
1.0	7.94	250	1.26
2.0	6.30	300	1.19
3.0	5.50	350	1.13
4.0	5.00	400	1.08
5.0	4.64	450	1.04
12.5	3.42	500	1.00
25.0	2.72	550	0.97
37.5	2.37	600	0.94
55.0	2.15	650	0.92
62.5	2.00	700	0.89
75.0	1.88	750	0.87
87.5	1.79	800	0.86
100.0	1.07	850	0.84
150.0	1.49	2 850	0.56

The results obtained on multiplying by the coefficients  $f$  the values calculated for 500 kg. of live weight, when compared with the figures obtained empirically, have shown that these coefficients may be considered exact within considerable limits.

When it is a question of determining the production of a pasture, the correction by means of these coefficients also gives more accurate results. Table II gives two instances of such a calculation.

TABLE II. — *Calculation of Production of 2 Pastures.*

No. and kind of animals at grass	Average live-weight kg	No of days of grazing	Total production expressed as grazing-days per 500 kg. of live weight		
			Simple calculation	Factor /	Corrected calculation
Pasture I					
5 cows . . .	500	80	400.0	1.00	400.0
2 oxen . . .	700	50	140.0	0.89	124.6
11 calves . . .	300	120	792.0	1.19	942.5
10 sheep . . .	62.50	150	187.5	2.00	375.0
4 colts . . .	350	150	420.0	1.13	474.6
Total . . .	—	—	1 939.5	—	2 316.7
Pasture II					
5 cows . . .	450	80	360.0	1.04	374.4
2 oxen . . .	600	50	120.0	0.94	112.8
14 calves . . .	250	120	840.0	1.26	1 058.4
13 sheep . . .	50	150	195.0	2.15	419.2
4 colts . . .	250	150	300.0	1.26	378.0
Total . . .	—	—	1 815.0	—	2 342.8

If the simple (uncorrected) calculation is taken as the basis, pasture II will have produced less than pasture I, but if the corrections are made by means of the coefficients for the different classes of animals, the production of pasture II is greater than that of pasture I.

184. — **Researches on the Value of Different Processes of Disintegrating Straw (1) in Germany.** — I. HONCAMP, F., Ueber Strohaufschliessung, in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XCV, Parts 1-3, pp. 69-89. Berlin, 1919. — II. HANSEN, I., Die Aufschliessung von Stroh mit kalter Natronlauge nach dem Verfahren von BECKMANN D., in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Vol. XXXIV, Part 4, pp. 41-44. Berlin, 1919. — III. HONCAMP, F. and BALMANN, F., Untersuchungen über den Futterwert des nach verschiedenen Verfahren aufgeschlossenen Strohes, II Mitteilung: Aufschluss des Strohes durch Aetzkalk mit und ohne Druck (Mitteilung der Landwirtschaftlichen Versuchs-Station Rostock), in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XCVIII, Parts 1-2, pp. 2-41. Berlin, 1921. — IV. HONCAMP, F., and BAUMANN, F., Untersuchungen über den Futterwert des nach verschiedenen Verfahren aufgeschlossenen Strohes III Mitteilung: Aufschluss des Strohes mit Soda (Mitteilung der landwirtschaftlichen Versuchs-Station Rostock), *Ibidem* Vol. XCVIII, Parts 1-2 pp. 43-63. Berlin, 1921.

I. THE METHODS HITHERTO EMPLOYED IN THE DISINTEGRATION OF STRAW, AND THE CHIEF RESULTS OBTAINED. — The final object of all these methods is to increase the digestibility and forage value of straw

(1) See R., April 1921, No. 406. See also MAGNUS, H., *Theorie und Praxis der Strohaufschliessung* (Aus dem Laboratorium des Kielegsausschusses für Ersatzfutter). Verlagsbuchhandlung Paul Parey, Berlin, 1919 and VON WISSEL, Beitrag zur Ermittlung eines einfachen und zuverlässigen Verfahrens die Höhe des Aufschliessungsgrades von Kraftstroh und dergleichen analytisch festzustellen, *Die landwirtschaftlichen Versuchs-Stationen*,

in general by treating it with chemical agents having the power to free the fibre from its surrounding elements, especially lignin, so as to assist the bacteria in breaking up and destroying the cellulose. It is, however, now admitted that the complete removal of the lignin is not necessary in the disintegration of straw, but that it is rather a question of softening the crude fibre and breaking down the strong connection between the lignins and the cellulose. Whereas satisfactory results have been obtained with alkalis and caustic soda, the disintegration of straw by the action of acids was a failure. The researches of PRINGSHEIM and MAGNUS made clear the changes undergone by the straw during its treatment with caustic soda, quick-lime and carbonate of soda. During disintegration with caustic soda, first the silicic acid and then the lignin are removed.

The best method of disintegration is BECKMANN'S, the straw being treated cold with alkalis and under ordinary pressure.

The author carried out a series of feeding experiments using straw that had been disintegrated by the three alkaline processes, and ascertained the loss of crude nutrient substances entailed by the disintegration. The disintegration of straw under pressure with caustic soda caused the destruction of part of the organic matter containing all the groups of nutritive substances.

Disintegrated straw from different species of plants was fed to sheep and its effects compared with crude straw of similar origin.

The straw of autumn cereals lends itself best to disintegration. After treatment with 3.5, or 7 % caustic soda the digestibility of the straw was increased respectively 72 and 94 %.

The results so far obtained may be summarised as follows : the increase in the food value due to disintegration, which shows itself in the increased starch value, is very great in the straw of autumn cereals, but slight in straw from Leguminosae and Cruciferae.

II. DISINTEGRATION OF STRAW BY COLD SODA LYE ACCORDING TO BECKMANN'S PROCESS. — This process, which has been patented, is carried out in the following manner by the "Veredelungsgesellschaft für Nahrungs und Futtermittel, Bremen and Berlin": chopped straw is

Vol. XCVI, Parts 5-6, pp. 263-275 Berlin, 1920 — In this contribution to the search for a simple, sure process for the analytic determination of the extent to which the straw had been disintegrated by the treatment ( "Kluftstroh" ) etc., the results obtained by the different processes are given viz.: 1) phloroglucin test; — 2) WEENDE's method — 3) gravimetric method — 4) volumetric method — 5) WOHL's calcium chloride method. The results show that in order to ascertain the extent to which the straw has been disintegrated, it is necessary not only to analyse the straw that has been treated but also the crude straw, and further the disintegration process adopted must also be known. A short description is given of 3 hitherto untested processes invented by: 1) WAENTIG and GIERSCHE (see R. Dec. 1921, No. 1244) — 2) MACH and LEDERLE, *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XI, p. 274. Berlin, 1917 — 3) WILLSTÄDTER (See R. Dec. 1921, No. 1244). (Ed.)

placed in flat boxes made of wood or tin (the fixed height being about 50 cm.: the surface area, 2 sq. metres per quintal of straw); 8 times its weight of 1.5-2 % soda lye is then added and allowed to act for 12 hours; the mixture requires stirring from time to time.

The boxes should be put in tiers so that the lye, which is used 3 times, can be collected and used successively in each of the lower boxes. The alkaline lye can easily be removed from the straw by washing.

FINGERLING has compared the digestibility of straw disintegrated with a cold ("Kaltstroh"), and a hot lye respectively. He obtained the results given in Table I.

TABLE I. — *Comparative Digestibility of Straw disintegrated by COLSMANN and BECKMANN'S Processes.*

Nutritive substances	Straw disintegrated by boiling (COLSMANN process)	Straw disintegrated by cold lye (BECKMANN process)	
		for 3 days	for 12 hours
Organic matter . . . . .	58.77 %	72.76 %	71.08 %
Nitrogen-free extracts. . . . .	35.89	79.59	63.55
Fat . . . . .	—	69.01	84.76
Crude fibre . . . . .	73.28	70.36	78.86

The author uses a BECKMANN process plant at the Agricultural Institute of the University of Königsberg. The average water consumption is 4.02 cubic metres per quintal of crude straw; this gives an average yield of 4.1 quintals of damp, disintegrated straw containing on an average 16.9 % of dry matter. The loss in dry matter was 22.4 % instead of 37.16 %, as is the case with the COLSMANN process.

It takes 20.8 litres of cold soda lye to disintegrate 100 kg. of crude straw, but 16 litres of boiling lye are sufficient. The content of digestive nutritive substances determined by the author is given in Table II.

HANSEN has also made experiments to find out the food value of straw disintegrated with a cold lye and a boiling lye respectively. It was impossible to make accurate determinations in the case of horses (which prefer straw that has been disintegrated with cold lye), on account of the nature of their performance. On the other hand accurate experiments were carried out for 3 months with milch cows. The deviations observed in milk yield and fat production were very slight.

HANSEN found from his experiments that disintegration for 3 days with cold lye gives to rye straw a nutritive value equivalent to that resulting from treatment with boiling lye according to COLSMANN'S process. Cold disintegration has also this additional advantage over boiling, that it can be carried out on any agricultural farm possessing a suf-



ficient water supply, for the plant required is very simple and much less expensive than that used in the COLSMANN process.

TABLE II. — *Digestible Nutritive Substance Content of Straw disintegrated with Cold Lye ("Kaltstroh").*

Nutritive substances	Straw disintegrated by cold lye		Dry matter of disintegrated straw	
	treated for 3 days	treated for 12 hours	treated for 3 days	treated for 12 hours
Dry matter . . . . .	16.29 %	16.81 %	100 %	100 %
Nitrogen-free extracts . . . . .	4.18	4.63	25.59	27.54
Crude fat . . . . .	0.18	0.19	1.10	1.11
Crude fibre . . . . .	6.66	6.44	40.93	38.32
Starch value . . . . .	9.50	9.72	58.32	57.79

III. DISINTEGRATION OF STRAW WITH MILK OF LIME BOTH WITH AND WITHOUT PRESSURE. — The experiments of the authors have demonstrated that the disintegration of straw by milk of lime also causes greater losses of organic matter when the process is carried out under pressure than when no pressure is applied. The fibre does not appear to be attacked. With this process the amount of investing substances removed (lignin + silicic acid) is less than when caustic soda is used, but as the proportion of the organic matter and especially the crude fibre is almost as large in the resulting product as in straw that has been disintegrated by soda, it is evident that the amount of lignin present in a disintegrated straw is not an exact measure of the extent to which the process has been carried out.

The starch value of straw disintegrated by quick-lime is much superior to that of crude straw, being in the first case 48.68, and in the second 13.29.

The above shows that disintegration with lime with or without pressure increases the food value of the straw almost as much as treatment with caustic soda.

The damp, disintegrated straw was eaten by the stock without any bad effects, no digestive disturbances being observed. The lignin was completely undigested. The digested portion of the crude fibre, as determined by the methods of WEENDE and CROSS, had almost the same composition as refined fibre.

IV. DISINTEGRATION OF STRAW WITH CARBONATE OF SODA. — The straw is boiled for 3 hours with 8 times its weight of an 8 % solution of carbonate of soda, just as in the cases where quick-lime or lime is used. The fibre is not attacked, but the pentosans are probably much affected.

Experiments in feeding sheep on rye-straw disintegrated by boiling

with 8 % milk of lime under pressure for 5 hours and with carbonate of soda of the same concentration, but for a shorter time, have shown that the latter process is the more effective. The respective digestibility coefficients of the rye straw in either case are given in Table III.

TABLE III. — *Digestibility coefficients of rye-straw disintegrated with lime and carbonate of soda respectively.*

	Disintegration with lime	Disintegration with carbonate of soda
Organic matter . . . . .	53.4 %	60.6 %
Nitrogen-free extracts . . . . .	32.2	41.0
Crude fibre . . . . .	75.7	80.2

The starch value of the straw disintegrated by lime was 47.1, whereas that of the straw treated with carbonate of soda was as high as 55.6.

The crude fibre estimated by CROSS differed from that determined by WEENDE'S method in having almost the same composition as pure fibre. In the same manner the digested portion of CROSS'S crude fibre was entirely similar in composition to the digested portion of the pure fibre.

185 — **Researches Made in the United States on the Sodium Chloride Content of Stock Feeds.** — FRAPS, G. S. and LOMANITZ, S., in *Texas Agricultural Experiment Station* (Division of Chemistry), *Bulletin* No. 271, pp. 5-14 College Station Texas, October, 1920.

In estimating the sodium chloride content of a mixed feed, it is necessary to know the amount of this substance in the ingredients used. The sodium chloride content of a mixture can be calculated either from the average composition, or from the maximum of each of the ingredients. The excess of salt found over that calculated is to be regarded as due to an addition.

The authors have determined the chloride content (expressed as sodium chloride) in a number of feeds by the method of incineration in the presence of sodium carbonate. As the Official A. O. A. C. (Association of Official Agricultural Chemists), method was too lengthy for examining a large number of feeds, the authors tried a more rapid method (which they describe in detail), giving results that agreed well with the official system.

The following Table shows that all unmixed feeds except lucerne, molasses and some meat products are low in chlorides.

An approximate method for estimating the added salt in a mixed feed is to subtract 1 % of the sum of the lucerne and molasses from the salt content calculated to sodium chloride, or better still, by comparison with the sodium chloride averages obtained for the ingredients of the feed.

TABLE.

Feeds	No. of samples	Minimum	Maximum	Average
Lucerne Hay (western) . . . . .	14	0.42	1.89	0.98
Chopped Barley . . . . .	21	0.10	0.26	0.16
Velvet Beans . . . . .	6	0.01	0.04	0.03
Dried Beet Pulp . . . . .	3	0.37	1.47	0.87
Dried blood . . . . .	1	0.75	—	0.75
Dried Brewers' Grains . . . . .	3	0.04	0.06	0.05
Cocanut meal or cake . . . . .	14	0.84	1.73	1.11
Maize bran . . . . .	15	0.06	0.17	0.10
Chopped maize . . . . .	20	0.08	0.13	0.09
Maize feed meal . . . . .	3	0.08	0.11	0.10
Ground maize and cobs . . . . .	3	0.12	0.23	0.16
Chopped ear maize with sheaths . . . . .	3	0.11	0.21	0.15
Cold-pressed cotton seed or meal . . . . .	15	0.05	0.16	0.07
Ordinary cotton seed meal or cake . . . . .	29	0.05	0.15	0.07
Prime cotton-seed meal or cake . . . . .	9	0.05	0.08	0.06
Broken or ground cottonseed meal or cake . . . . .	3	0.06	0.10	0.08
Peterita (var. of sorgum) . . . . .	3	0.11	0.19	0.15
Fish meal . . . . .	3	0.48	0.76	0.57
Graham Flour . . . . .	1	0.12	—	0.12
Rye Flour . . . . .	1	0.13	—	0.13
Hominey Feed (maize bran and gluten ground together) . . . . .	19	0.06	0.30	0.12
Chopped kafir (var. of sorgum) . . . . .	2	0.06	0.07	0.07
Kafir (head stems) . . . . .	1	0.13	—	0.13
Linseed meal . . . . .	5	0.04	0.06	0.05
Meat meal . . . . .	2	2.58	2.95	2.17
Meat scraps . . . . .	8	0.58	1.91	1.31
Chopped milo (var. of sorgum) . . . . .	13	0.07	0.15	0.10
Milo Head chopped or Ground . . . . .	3	0.13	0.15	0.14
Molasses . . . . .	14	0.90	1.35	1.12
Ground Oats . . . . .	15	0.09	0.24	0.14
Rolled Oats . . . . .	2	0.09	0.17	0.13
Chopped Oats . . . . .	1	0.19	—	0.19
Ground Oat Hulls . . . . .	2	0.10	0.15	0.13
Pea-nut Feed No. 4 . . . . .	4	0.05	0.15	0.08
Pea-nut Hulls . . . . .	3	0.08	0.09	0.08
Prime Pea-nut meal or Cake . . . . .	2	0.04	0.06	0.05
Ordinary Pea-nut meal or Cake . . . . .	8	0.04	0.17	0.06
Pea-nut Stems . . . . .	1	0.20	—	0.20
Pea-nuts whole pressed . . . . .	6	0.03	0.10	0.06
Rice Bran . . . . .	31	0.08	0.19	0.11
Cracked Rough Rice . . . . .	7	0.10	—	0.10
Rice Hulls . . . . .	1	0.13	—	—
Chopped Rye . . . . .	1	0.13	—	0.13
Ground Screenings . . . . .	1	0.41	—	0.41
Sorghum Fodder . . . . .	1	0.08	—	0.08

TABLE (cont.).

Feeds	No. of samples	Minimum	Maximum	Average
Sorghum Silage, Dried . . . . .	1	0.54 %	—	0.54 %
Tankage . . . . .	8	0.23	2.99 %	1.53
Ground Wheat . . . . .	2	0.13	0.20	0.16
Wheat Bran . . . . .	17	0.06	0.16	0.12
Wheat Bran and Screenings . . . . .	18	0.07	0.20	0.14
Wheat Bran Screenings and Scourings . . . . .	1	0.10	—	0.10
Wheat Bran, Shorts and Screenings . . . . .	1	0.06	—	0.06
Chopped Wheat . . . . .	6	0.11	0.25	0.13
Wheat Grey Shorts . . . . .	19	0.09	0.19	0.12
Wheat Brown Shorts . . . . .	9	0.08	0.16	0.11
Wheat Screenings . . . . .	5	0.13	0.34	0.20
Wheat white Shorts . . . . .	3	0.12	0.13	0.13
Tumble weed ( <i>Amaranthus albus</i> ) . . . . .	1	0.38	—	0.38
Bear Grass ( <i>Camassia esculenta</i> ) . . . . .	1	0.13	—	0.13

186 - **Gemsbok Beans Budlake (*Bauhinia esculenta*) as Feeds for Cattle.** — See No. 162 of this Review.

187 - **The Change in the Fat of Peanut Fed Rabbits.** — DOWELL, S. T. (Oklahoma Agricultural Experiment Station, Stillwater), in *Science*, Vol. LIII, No. 1377, p. 487. Lancaster, Pa., May 1921.

In order to determine whether an animal in starving uses the liquid fat more rapidly than the solid, rabbits were fed on peanuts and alfalfa for six weeks. One of the rabbits was killed at the end of the feeding period and the others were killed after starving for 3.5 and 7 days respectively.

The iodine numbers of the kidney fat and the back fat were determined. The results are shown as follows:

Rabbit. No.	Iodine number of back fat	Iodine number of kidney fat
1 (killed after feeding period) . . . . .	90.23	98.00
2 " " starving 3 days) . . . . .	78.34	97.92
3 " " " 7 " . . . . .	70.98	95.33
4 " " " 7 " . . . . .	66.22	92.36

The percentage of liver fat extracted by ether was respectively 8.15, 17.04, 19.18 and 20.9 for the rabbits, series 1-4, but the iodine number remained constant, showing values from 98 to 104.

The results indicate that the liquid fat of an animal during starvation is used more rapidly than the solid, and the liquid fat of the back or subcutaneous fat is more rapidly consumed than that of the kidney.

This investigation is important from the point of view of the soft pork question from peanut fed animals. It suggests that if both liquid and solid fat were fed at the same time, greater proportion of liquid fat would be used to meet the energy requirements of the body, and this would make it possible to overcome the softness of the pork of peanut fed hogs.

Results obtained in the spring indicated that it is preferable to feed the peanuts with other feeds for 70 days rather than to feed for 40 days with peanuts alone and then to finish with other feeds.

The author intends to repeat this work, using pigs as his subjects instead of rabbits.

188 - **The Dongolao Horse.** — TARANTINO, G. B. (Osservatorio zootecnico della Colonia Eritrea), in *Allevamenti*, Year II, No. 7, pp. 196-198, figs. 5, No. 8, pp. 231-232, figs. 2. Palermo, July 1, 1921, August 1, 1921.

HORSES

In Eritrea and especially at Hamasien excellent horses used formerly to be bred. At the present time, horse-breeding is no longer practised and horses are imported, the greater number coming from Abyssinia and specially from Tigrai. Two horse-breeding attempts made by the Italian Government in 1903 at Godofelassi, and in 1918-1919 at Sahel (Nacfa) were unsuccessful. In the districts of Barca, Gasc and Setit, which are the most suited to horse production, there are a few private stud-stations belonging to the Chiefs of the tribe.

The main cause of the almost complete disappearance of horse-breeding in Eritrea is the prevalence of horse-pest. The author states, however, that this disease could easily be prevented by the help of well-directed prophylaxis.

The horse bred in Eritrea and in general throughout Abyssinia, is of the Dongolao or Dongolaw type, so called from Dongola, its place of origin the northern portion of Nubia and the Sudan. It is clearly distinct from the eastern type and is probably the result of a very old cross between native and western breeds. The Dongolao is a luxury horse and highly prized. Its conformation is good, but the joints are weakened by the practice of hobbling from earliest youth whenever they are turned out. The measurements taken by the author were as follows: height at withers 1.45 m., height at croup 1.45 m., height at cannon bone 0.45 m., length of head 0.54 m., length of neck (sinciput withers) 0.87 m., length of neck (throat-chest) 0.57 m., circumference of thorax 1.10 m., circumference of abdomen (umbilicus) 1.26 m., length of trunk (point of shoulder to croup) 1.05 m., width of croup 0.48 m., distance between the shoulders 0.48 m., length of shoulder 0.61 m., circumference of knee 0.30 m., circumference of hock 0.37 m., circumference of cannon-bone 0.18 m.

The Dongolao is exclusively a saddle-horse. The methods of breeding leave much to be desired. The stallions and broodmares do not receive the care necessary and the colt sucks its dam for 40 to 60 days and is also given cows' or camels' milk. When about 2 years old, a child is put on its back and the animal is led to the pasture or watering-place, two of its feet being hobbled laterally or diagonally in order to accustom it to amble.

When it is about 30 months old, it is mounted by a good rider.

The author describes the various components of the harness of the Dongolao horse and concludes by expressing the hope that the Government will take measures to arrest the retrograde movement in the breeding of this fine animal. This could be done by choosing Arab sires, by constructing shelters to protect the horses during the night from the attacks of many insects that spread diseases, and by feeding rather more liberal rations of barley or doura.

189 - **Essay on the Depreciation in the Market Value of Broken-Kneed-Horses.** —

NICOLAS, P., in *Recueil de Médecine Vétérinaire*, Vol. XCVII, No 20, pp. 399-407. Alfort, October, 1921.

The disputed claims that frequently have to be adjudged in this connection are of considerable importance on the economic side, and very difficult to settle on account of the small amount of assistance given by writers on the subject.

The losses the third party responsible for the accident is required to make good are of two kinds: 1) *Remediable injury*: feeding, cost of treatment, and if necessary, the expense of replacing the animal. The assessment of these damages generally comes within the scope of the judicial police and can usually be made without difficulty. — 2) *the loss due to the depreciation of the animal* should the accident have left any definite mischief or sequelae. This is where the difficulty begins. How far has the owner a right to compensation for this depreciation in the value of his horse?

The author has studied the reason for the depreciation of the broken-kneed horse, and finds it may be ascribed to the three following causes which he examines separately: 1) functional trouble, 2) possible weakness of limbs and predisposition to falling; 3) unsightly nature of the scar.

1) *Functional trouble.* — This is relatively rare. Where it exists, it gives rise to lameness and the economic loss must be estimated under this head.

2) *Possible weakness of the legs and predisposition to further falls.* — This point holds good for all horses no matter to what category they belong. It is obvious however that its importance varies with the class of animal, since the consequences of another fall should it occur, would be very different in the cases of a saddle-horse, a post-horse or draught horse. It may therefore be said that the consequences to be feared in the case of a broken-kneed horse are proportionate to  $mV^2$ . If the relative values of  $V$  are determined for galloping, trotting and walking, the necessary data for judging the depreciation caused are obtained. Thus, calculated as a function of the height  $H$  of horses, these values are, according to the authorities on the subject (1)  $\frac{3}{4}$  (no work):  $\frac{6}{4}$  (trotting);  $\frac{9}{4}$  (galloping) or as 1: 2: 3, and their squares as 1: 4: 9.

The author, in calculating the depreciation on the case of the three

(1) DECHAMBRE, *Traité de zootechnie*, Vol. 1, p. 350. (Author's note)

classes of horses, devised the following general formula summarising the total depreciation incurred by a broken-kneed horse (2).

$$\text{Depreciation} = \frac{\left( Vba - \left[ P \times p \times \frac{10}{8} \right] \right) V^2}{9}$$

As is seen, the horses are grouped in 3 categories according to the use that is generally made of them (and hence according to their paces and speed), which may be characterised by 3 types : 1) the saddle-horse of which the pace is a gallop ; 2) the post horse which trots ; 3) the draught horse which walks. These types depend to some extent on the same principle as the assessment of the depreciation and are its logical outcome. As the value of the horse before the accident forms part of the depreciation formula, the depreciation cannot be out of proportion to the worth of the animal. A horse of 500 kg. and bought for 1500 francs, whether a riding or driving horse, a trotter or walker, will be depreciated to the same ultimate extent, according to the formula, if the price of horse-meat is 2.50 fr., which is perfectly just, as the meat has not decreased in value, and therefore cannot have become depreciated. Reciprocally, the most valuable horses are most depreciated by such an accident.

3) *Unightly nature of the scar.* — This is only of importance in the case of the riding or driving horse. A broken-kneed animal cannot be used for either purpose, for it is blemished, and must sink to the level of a rejected horse. Its value is given by the following formula :

$$\text{Depreciation} = Vba - \left( P \times p \times \frac{10}{8} \right)$$

Depreciations are not cumulative, one excludes another, and it is the most important that is taken into account. Thus a horse loses nothing more of its value by breaking its knees a second time, unless the second fall produces some functional trouble that did not exist before, in which case the depreciation is estimated for lameness.

In short it is clear that if the owner claims a given sum as damages, the expert will only acquiesce if this is below the amount of depreciation which would logically follow from his deductions. The expert will however explain his views to the judge, so that he may understand that the opinion depends upon sound reasoning.

190 - **Comparative Feeding Value of Sunflower Silage and Darso Silage for Fattening Baby Beef during the Final Stage of Fattening. Experiments in the United States.** — BLIZZARD, W. L., in *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station, Bulletin No. 131*, pp. 3-7. Stillwater, Sept. 1920.

CATTLE

Experiments covering a period of 150 days conducted at the U. S. Indian School at Chilocco (Oklahoma), with 14 calves registered Hereford ♂ × Shorthorn ♀ (high grade). These animals were calved the previous

(2) The coefficient 10 which is obtained from the work capital and the flesh capital of a rejected horse may vary with the season and the place. (*Authors' note.*)

spring, weaned in October and divided into two lots, each receiving a ration of ground maize, cottonseed meal, and lucerne hay, but Lot I received in addition sunflower silage, and Lot II, darso (sorghum var.) silage.

The average percentage composition of sunflower and darso silage is shown as follows, respectively: water 71.96 and 73.11; ash, 3.23 and 1.54; protein, 2.96 and 1.91; fibre 8.67 and 6.46; nitrogen free extract 12.36 and 16.65; fat 0.81 and 0.34.

The results of these experiments (January 16 to June 17, 1920) are collected in the appended table.

These results indicate that darso silage combined with the given ration, has proved to be practically equal in value to sunflower silage for encouraging beef production

### *Results of Feeding Test.*

		Lot I 7 animals	Lot II 7 animals
		lb.	lb.
Feeds consumed per day per head . . .	Ground maize . . . . .	11.00	11
	Cotton seed meal . . . . .	1.07	1.07
	Sunflower silage . . . . .	13.00	—
	Darso silage . . . . .	—	13.00
	Alfalfa hay . . . . .	2.00	2.00
Initial weight . . . . .		2996.00	2971.00
Average initial weight . . . . .		428.00	424.00
Final weight . . . . .		5348.00	5382.00
Average final weight . . . . .		763.00	769.00
Total gain . . . . .		2377.00	2411.00
Gain per head . . . . .		335.00	345.00
Average daily gain per head . . . . .		2.24	2.29
Initial cost per head . . . . .		36.71\$	36.43\$
Initial cost per group . . . . .		257.00\$	255.00\$

191 - **Effect of Shelter and Temperature of the Drinking Water on the Increase in Weight of Fattening Cattle** (1) Experiments in the United States. — POTTER, E. L., and WITHYCOMBE, R., in *Oregon Agricultural College Experiment Station, Eastern Oregon Branch Station, Bulletin No 183*, pp. 5-11, Corvallis, Oregon, Sept. 1921.

Experiments conducted over a period of several years at the Eastern Oregon Branch Station with cattle and dairy cows have shown that fattening cattle, fed under shelter and having access to a paddock, consume a quantity of feed equal to that consumed by animals reared in the field, and the actual gain established is comparatively negligible. The results obtained with fattening dairy cows indicated no noticeable difference whatever.

As regards the effect of the temperature of the water, results obtained with cattle stock showed that the effect is practically nil both with reference to food consumption and to increase in weight.



192 - The Gascon and Lauraguaise Breeds of Pigs in France. — GIRARD, Les races porcines méridionales, in *Revue Vétérinaire*, Vol. LXXIII, 3<sup>rd</sup> series, Vol. II, pp. 82-95 and 466-485. Toulouse, February and April, 1921.

It is estimated that there are over 1 200 000 adult pigs in the south of France which are unequally distributed among the 12 departments forming the secondary basins of the Aude and the Adour. These animals may be black or white, but are most commonly piebald; they form more than one-fifth of the total number of pigs in the country. The pigs of the south of France, unlike those of the North, all belong to the type with pointed snout and horizontal ears known as the "mole-headed or circum-mediterranean breed" living in Africa, and also found in Spain, Portugal, Italy and the whole of South and Central Europe. Some are pure-bred animals, others are the results of crossing the mole-headed race with English pigs or white Celtic breeds.

Taken as a whole they form a large and very distinct ethnical group, in which 5 chief races can be distinguished: the *Gasconne*, *Lauraguaise*, du *Quercy*, *Pyrénéenne* and *Périgourdine* or *Limousine* with 2 sub-races or varieties: the *Miélan* and the *Cazère*. The author while proposing to provide a detailed description of the history, habitat, centres of production, and also of the morphological and physiological characters of these breeds, deals in this paper first with the Gascon and with the Lauraguaise breeds, reserving the other for future publications.

THE GASCON BREED OF PIGS. — This race is now quartered at Nebouzon, a small district of Gascony enclosed by Armagnac, Couserans, Comminges, and Lomagne. Its economic capital, Boulogne-sur-Gesse, has become the centre of the production and the chief market for this breed, which although rather late in developing, is much prized and sought after, on account of its resistance to disease and the quality of its meat.

The breed is very ancient, not yet officially recognised but probably indigenous, and the original stock of all the above mentioned races, as it dates back to prehistoric times. In any case this pig has always been found both in the French and Spanish Pyrenees and its colour was always black.

The adult animal is about 0.75 m. in height (the hind quarters slightly exceed this measurement). At a year old its weight varies around 100 kg., being 150 kg. when it is 18 months old, 200 kg. at 2 years, and may reach 250 or even 300 kg., in the case of fattened animals when 30 months old: some show specimens have weighed over 350 kg.

The Gascon pig is entirely black, its skin is completely and heavily pigmented, the bristles are black throughout their length, the snout and hoofs are black without a trace of any other colour. Any white or grey markings are a proof of crossing with white English breeds, or with the Craonnaise, and disqualify the animals for breeding purposes.

The frame-work of these pigs is strong without being heavy. The skin is thick and coarse but flexible, and is covered with long stiff hairs distributed differently in the various parts of the body, but always allowing

the brown skin with its copper-coloured lights to show through. There is no dewlap or tuft. Many of the animals have on their necks, between the shoulders and the beginning of the back, tufts of longer and stronger bristles pointed in the reverse direction and forming rosettes or brushes. Such animals are much in request with pig-breeders, who declare that they are more resistant than others to changes of temperature, especially to heat.

The limbs of these swine are light and at the same time solid, indicating a strong animal and a good walker. The framework and conformation are regular, showing the type to be eumetric, rectilinear, with medium lines, though possessing a slight tendency to elongation; the body is somewhat compressed, and the outline a little irregular at the withers and hump.

The head is narrow, clearly truncated and very long, especially in the facial portion, which is straight and pointed, terminating in a small, solid, very mobile snout specially adapted to rooting in the ground. The ears are of average length, rather thin, somewhat narrow, close together at the base, and slightly divergent for the rest of their length, carried horizontally or slightly drooping, so as to form a pent-house above the eyes.

Taken altogether, the head is narrow and the outline both above and below is nearly straight thus imparting to the face its characteristic shape of a truncated cone or "moles' head".

The neck is long and fat, compressed in the region of the throat and without dewlap. The upper portion is slender and straight; it is rather narrow where it joins the shoulders but always very muscular.

The body is almost cylindrical, slightly elongated beneath the dorso-lumbar line which is distinctly straight. The chest is always a little narrow, the hind quarters on the other hand are short, oval, and broad, terminating in a fleshy well-rounded ham; the strongly developed crural masses give the hinder parts of the fattened pig the appearance known as "colt-rumped".

The abdomen is generally well-supported and round. The tail should be long strong and covered to the tip with short hairs, large at the base, tapering at the point and terminating in a tassel of long coarse hair, curly in young pigs, and straight and pendent in fat adult animals.

The height and conformation of the pigs vary greatly according to the districts where they are reared and the breeding conditions. As a rule, they are a good criterion of the fertility of the soil. The average morphological type as represented by a boar 18 months old may be described as follows:

Height at withers . . . . .	0.75 m.	Width of chest . . . . .	0.35 m.
Height of back . . . . .	0.78 "	Height of chest . . . . .	0.40 "
Height at croup . . . . .	0.71 "	Width of croup . . . . .	0.35 "
Length of body . . . . .	1.20 "	Length of ears . . . . .	0.20 "
Length of head. . . . .	0.40 "	Width of ears (at base) . .	0.10 "
Length of croup . . . . .	0.35 "	Average length of hair . .	0.06 "

The sow is always a little lower, flatter and longer.

Fattened animals are nearer the ground, more thick-set and rounder;

they have a larger collar and wider croup ; the line of the back is straighter, sometimes interrupted in the middle.

It is noticeable that after the age of 18 months the Gascon pig increases little in height and length ; it simply puts on fat which is deposited in a layer under the skin. This layer of fat may become 15 cm. thick on the back and chest, which makes the animals look thick-set and shorter.

The Gascon breed is hardy, vigorous and very prolific, but matures late. These pigs turn to excellent account the liberal rations that may be given them. When well-fed from the first, and comfortably housed in healthy, clean piggeries, the animals grow quickly and furnish a large amount of good meat from the age of 10 months. As a general rule, however, they do not fatten easily until they are 2 years old.

The only food they are given are potatoes and maize (especially the latter), mixed with pig-wash, scalded bran or crushed boiled beans. It is reckoned that, during the 3 months of fattening, the pig consumes 5 hectolitres of maize and gains about 80 kg. in weight, viz., a little less than one kilo a day.

The breed has the great merit of providing for family use the type of butcher's animal that is becoming rare in France.

The Gascon pig, when well fattened, satisfies all the requirements of the peasant consumption of the district.

Its yield is fairly high, being as much as 85 %. It gives a large proportion of very delicate fat, strong intestines and much blood (10-12 kg.). This pig is therefore very useful to the pork-butcher, and to the house-wife. The meat is excellent, of a fine red colour, very firm though tender, nutritious and of good flavour. The two elements constituting fat meat are distinct in this pig ; the fat is little dispersed and the meat is close ; nearly all the fat is in a covering layer and there is a good supply of lard. These qualities are much prized by the southern peasants who expect the pig to provide them, not only with a stock-pot, the basis of their food supply, but also with the fat required for cooking.

II. LAURAGUAISE BREED OF PIGS. — This breed deserves mention among the chief races in the South, for it is of ancient native origin and still makes its influence felt, as in the past, upon pig-breeding in the south of France. It is a near relative and cousin-german of the Gascon race, but only numbers 100 000 animals, all of which are confined to the upper basin of the Garonne. This pig is a product of the two great types, the *Iberian* and the *Celtic*, a little *Asiatic* blood having been introduced by crossing with English breeds. Its special well-defined characters due to the adaptations necessitated by the climatic and cultural conditions of the country have raised it to the position of a distinct breed. The evolution of this breed is described in detail in the author's long account of its history.

At the present time, the Lauraguaise breed which is derived from the *Iberian* and *Celtic* types, with some admixture of qualities borrowed from the *Large Yorkshire*, can be described as follows : tall, completely white, long but rather inclined to heaviness, frame strong, convex-linear, a little heavy and unsymmetrical, with "mole head", rather heavy semi-long

and semi-pendent ears. The average height of the adult animal is 0.80 m. but it varies from 0.05 m. to 0.08 m. in either direction according to the sex. The piglings of this breed which are fatter and longer when farrowed than those of other races, generally weigh 20 kg. when they are weaned (at the age of 2 ½ months). When sold at about 4 months old, their average weight is 35 kg, and under ordinary conditions they easily weigh 60 kg. when they reach 6 months. When 1 year old boars weigh 125 kg. and sows from 90 to 100 kg; after attaining their full development both weigh 200 or even 250 kg, and after fattening, may turn the scale at 350 kg.

As was said above, these pigs are quite white. The skin is completely without pigment, and is of a yellowish-white free from spots or lights. A few brown or bluish spots are not infrequent on the head or croup, but the breeders are doing their best to eliminate them.

The coarse, long, thick hair which grows freely on the withers, neck and lower portions of the limbs is of a dirty white and assumes a yellowish tinge in old animals.

The head is strong and always a little heavy. One of the chief characters of the Lauraguaise pig is the great development of the frame while the animal is still young. The boar is very large and massive with strong robust frame, well developed forelimbs, rather light hind limbs, wide, deep chest, relatively small abdomen, almost bent upwards at its posterior end.

The sow on the contrary although finer and narrower in front is remarkable for its great length of pelvis, broad quarters and prolapsed abdomen which sometimes in spite of its long legs almost sweeps the ground.

The animals of both sexes are specially noted for length of shoulders, width of chest and great development of the croup, which confer not only considerable weight, but also great body length. This may be as much as 2 metres in breeding-animals, if measured from the snout to the root of the tail. Many good specimens measure 0.90 m. at shoulder height, 1.55 m. around the chest, and 1.60 m. in length from the neck to the root of the tail.

The head is strong, somewhat heavy, narrow, and dry, a little overweighted by the ears, the profile is slightly receding, betraying a cross with the Celtic breed.

The skull is short, rather wide, with prominent occipital region and flat forehead. The face is flat, and forms a regular truncated cone, carrying a slender but very strong snout eminently adapted for rooting in the ground. The neck, which is thin at the point of attachment to the head, is very thick at its insertion on the trunk; it is muscular, very mobile and somewhat long.

Other details are given as to the body of this pig, which is well-fitted for a meat-producing animal. Its legs are also described. The two chief physiological merits of this breed which find favour with the agriculturists of the south and are the cause of its persistence in the region, are its fecundity and hardiness. The boars and sows are equally fertile and the Lauraguaise pig is strong and docile, well-adapted to sudden changes of temperature and to strong winds. It is easy to keep and a good forager.

From the economic point of view, the merits of this pig are the outcome of its origin, its conformation and its rearing. The animals grow large and fatten easily, but they do not show these qualities, at least under ordinary conditions, until they are fairly old, usually when about 12 or 14 months old.

The Lauraguaise breed thus represent a type of pig well suited to the requirements and condition of Southern countries, and though it is not perfect, nor even the best race of the region, it yet deserves to be more extensively kept.

193 - **Use of Forage Crops in the Fattening of Pigs. Experiments in the United States** (1). — ROBISON, W. L., in *Ohio Agricultural Experiment Station, Bulletin* No. 343, pp 165-222. tables 24 + figs. Wooster, Ohio, June 1921.

Experiments conducted from 1912-1918 with chiefly purebred Duroc Jersey pigs, farrowed in March and April.

Their object was to gain a knowledge of the most appropriate methods of supplementary feeding for pigs on forage. In most cases one or more groups of pigs were kept on the "dry lot" system for control purposes in order to determine the weight and economic value of the pasture crops.

Table I summarises the results of experiments made on clover pasture.

In a further experiment, the pigs were pastured on blue grass (*Poa pratensis*) with a certain amount of white clover; self-fed maize and tankage was given separately. The pigs thus treated gained at the rate of 1.16 to 1.15 lb. daily per head; and per 100 lb. of gain, consumed 320.6 and 321.5 of maize and tankage respectively.

A number of experiments were conducted with rape pasture. The results of several are summarised in Table II.

Three experiments (Nos. 11, 12, 13) were made with pigs weighing respectively 99; 79; and 68 lb. pastured on rape with a supplementary feed of shelled maize + tankage, in order to compare the self-feeding with hand-feeding. The self-fed lots gained weight more rapidly than the hand-fed, although in 2 experiments with younger pigs, the hand-fed lots showed a gain.

In experiment 7 on rape pasture, a comparison was made between the effect of feeding with maize alone and self-fed maize and tankage given separately but in the same feeding. The pigs self-fed gained weight the most rapidly and at lower cost.

In experiment 7, on rape pasture, comparisons were made between full and limited supplementary rations. For the first 4 weeks, the ration consisted of middlings and tankage, ratio 14:1. This was followed by 17 weeks of hominy feed in place of middlings. For the pigs on full feed the average daily gain was 1.257 lb.; on approximately 2 lb. of concentrates daily per 100 lb. of live weight, 1.065 lb.; on an increased ration of 1

(1) See R. Sept. 1915, No. 942; R. July 1916, No. 780; R. Oct. 1916, No. 1103; R. July-Sept. No. 957; R. Oct.-Dec. 1919, No. 1197; R. Feb. 1920, No. 236; R. Nov.-Dec. 1920, No. 1175. (Ed.)

TABLE I. — *Comparison of Methods of Feeding Maize and Tankage to Pigs on Red Clover Pasture.*

Experiment	Method of feeding maize and tankage	Ratio of Maize to Tankage	Ration per 110 lbs weight	Initial weight per head	Length of test	Daily gain per head	Consumed per pound of gain		Gain accredited to an acre
							Maize	Tankage	
			lb	lb	Weeks	lb	lb	lb	lb
1	No tankage, full feed of maize . . . . .	—	3.67	34.4	18	0.80	3.88	—	55
	Free choice . . . . .	10 : 1	3.89	34.2	18	1.32	3.15	0.30	110
	Full feed, hand feed. . .	19 : 1	3.79	34.9	18	1.28	3.25	0.17	519
	Three-quarters of a full feed . . . . .	19 : 1	3.39	34.3	18	1.01	3.13	0.16	431
	Ditto 12 weeks; full feed 6 weeks . . . . .	19 : 1	3.54	31.5	18	1.14	3.14	0.17	537
2	No tankage; full feed of maize . . . . .	—	4.16	43.8	18	1.16	4.18	—	41
	Free choice . . . . .	23 : 1	4.28	42.6	18	1.40	3.84	0.16	119
	Full feed . . . . .	19 : 1	4.45	43.5	18	1.47	3.89	0.20	— 8
3 (1)	Full feed, hand fed . . .	15 : 1	4.19	48.4	12	1.03	3.48	0.24	374
	3 per cent. ration . . . .	15 : 1	2.93	48.1	12	0.62	3.28	0.22	220
	2 per cent ration . . . .	16 : 1	1.93	48.3	12	0.50	2.51	0.16	242

(1) In experiment 3 the proportion of maize in the rations was progressively increased.

TABLE II. — *Comparison of Methods of Feeding Maize and Tankage to Pigs on Rape Pasture.*

Experiment	Method of feeding maize and tankage	Ratio Maize to tankage	Rations per 100 lbs weight	Initial weight per head	Length of test	Daily gain per head	Consumed per lb of gain		Gain accredited to an acre
							Maize	Tankage	
			lb	lb	Weeks	lb	lb	lb	lb
4	Limited maize; no tankage . . . . .	—	3.30	51.0	12	0.88	3.29	—	268
	Four fifths of a full feed	9 : 1	3.60	52.1	12	1.18	2.79	0.31	(1)
5	Full feed. . . . .	14 : 1	4.21	39.9	15	1.26	3.30	0.24	(1)
	2 % ration; later full feed.	14 : 1	3.30	40.6	15	1.12	2.73	0.19	(1)
6	3 % ration throughout . . . . .	14 : 1	2.88	52.1	15	1.08	2.70	0.19	(1)
	2 % ration; later full feed.	14 : 1	3.09	52.3	15	1.22	2.75	0.20	(1)
8	Full feed of maize; no tankage . . . . .	—	4.11	35.3	18	0.88	4.23	—	366
	Increasing feed of maize; no tankage . . . . .	—	3.09	34.8	18	0.63	3.66	—	339
	Full feed . . . . .	19 : 1	3.89	36.4	18	1.06	3.61	0.19	625
	2 % ration; later full feed.	19 : 1	3.19	35.2	18	0.85	3.10	0.16	441
	Full feed . . . . .	9 : 1	4.01	35.1	18	1.10	3.42	0.38	430
	2 % ration; later full feed.	9 : 1	2.90	35.0	18	0.95	2.60	0.29	517

(1) Not computed, as no check groups were fed in the dry lot.

to 3 lb. of concentrates daily per 100 lb. live weight, 0.721 lb.; on 1 lb. of concentrates per 100 lb. live weight, 0.428 lb. The control lot, not on pasture, i. e. the full feed dry lot, showed an average daily gain of 1.031 lb. The limited concentrated rations were of economic advantage, but the average weight of those slaughtered was less.

In experiment 9, a comparison was made between the full and limited feeding on soyabean pasture. The lots given maize alone, full-fed, showed an average daily gain of 1.029 lb. per head; as against 1.022 for those which received  $\frac{1}{2}$  of the full feed. The first lot consumed 4.348 lb. and the second 3.427 lb. of concentrates per 100 lb. weight. Another lot which was given a full feed + tankage, ratio 9 : 1, showed an average daily gain of 1.177 lb. per head, and consumed 4.238 lb. of concentrates daily per 100 lb. weight. Yet another lot received  $\frac{4}{5}$  of the preceding feed and showed an average daily gain of 1.004 lb. per head and consumed 3.605 lb. of concentrates daily per 100 lb. weight.

Still further experiments were made (Nos. 14, 15, 16) to compare the relative effects of pastures composed of various forage plants to ascertain the value of:— (1) field peas and oats; 2) peas and rape; 3) rape and oats; 4) oats and soybean; 5) rape alone. It was noted that the rape alone furnished green feed for a longer period than the mixtures.

In experiment 17 a comparison between sweet clover and soybean pasture showed that the pigs found the sweet clover unpalatable.

## POULTRY

194 - **First Egg-Laying Competition in France.** — *Revue de Zootechnie* (1) Year 1, No 1, pp. 85-87, figs. 2. Paris, October, 1921.

The first French Egg-laying Competition was held in 1920-1921, at Vaulx-de-Cernay.

The results were rather poor as was to be expected from hens which were mostly from poultry-yards where it had not been possible to select for egg-production.

The lots of fowls placed in the highest classes at the end of the competition were as follows.

*French Light Breeds.* — Lot No. 11 (6 hens) laid 632 eggs of the average

(1) The object of this Review, which is the organ of the French "Office d'Élevage" annexed to the national centre of Experimental Stock-Breeding at Vaulx-de Cernay, is to form a link between: 1) French and foreign stock-breeding researches; 2) Scientific workers and stock-breeders; 3) Stockbreeders themselves; 4) French stockbreeders and their foreign customers. The Directors: M. DÉCHAMBRE, Professor of Zootechnology at the Ecole nationale d'Agriculture at Grignon, and the "Ecole nationale vétérinaire d'Alfort" and M. VOITELLIER, Professor of zootechnology, at the "Institut National Agronomique of Paris" described the programme (which includes amongst other subjects, summaries of the results of experiments; accounts of scientific researches; practical observations on animal production; bibliographical reviews, etc.), as follows: "An account of the work of the "Offices agricoles", reports of competitions and shows, the publication of the quotations of the chief markets with numerous illustrations explanatory of the text, together with information of a technical nature and useful suggestions as to the means of making stock-breeding in France profitable".



weight of 55 gm. The best hen in this class (a Gascon fowl), laid 186 eggs weighing on an average 54 gm.

*French Heavy Breeds.* — Lot No. 46 (Faverolles), laid 557 eggs weighing on an average 52 gm. The best hen of this class (a Gatinais bird), laid 142 eggs weighing on an average 58 gm.

*Foreign Light Breeds.* — Lot No. 79 (Ancona) laid 766 eggs weighing on an average 59 gm. The best layer in the whole competition belonged to this lot. It laid a total of 187 eggs (weighing on an average 59 gm), or more than 11 kg. of eggs.

*Foreign Heavy Breeds.* — The Buff Orpingtons laid 508 eggs. Average weight 61 gm. The hen placed first in this class belonged to this lot and laid 152 eggs each weighing 63 gm.

In comparing the results obtained for the different breeds as regards the French light breeds it was found that out of the 29 lots competing, only one gained more than 700 marks, 6 got over 600, 3 over 500 and 14 over 400. Out of 11 lots of French heavy breeds only one gained over 500 marks and 2 obtained more than 400.

Out of 16 lots of foreign light breeds 1 obtained over 800 marks; 2 over 700; 4 over 600; 5 over 500; and 4 over 400.

Finally, out of 4 lots of foreign heavy breeds, 1 lot gained over 600 marks and 1 over 500.

Thus the light breeds did better than the heavy.

195 - **Note on the South African Bee.** — SKAIFE, S. H., (Inspector of Technical Education) in *Journal of the Department of Agriculture (Journal of South Africa)*, Vol. II, No. 4, pp. 353-357, figs. 5. Pretoria, April, 1921.

BEE-KEEPING

The breeds of bees reared in Europe and America are rarely found in South Africa. Italian bees, which were at one time imported, do not seem to thrive.

The bees usually found in the hives have yellow bands, and belong to the *Apis adansonii* breed that is native to South Africa. *Apis unicolor* is chiefly met with in the Eastern districts; this bee is rarer, and less quiet than *Apis adansonii*, but an excellent worker.

Natural crosses between the two breeds appear to be of frequent occurrence, and in the same apiary workers of both types and intermediate forms produced by the same queen are often seen.

The pure *Apis adansonii* breed is well adapted to the conditions in South Africa; its characters vary considerably according to the different parts of the country.

As regards diseases, the European foulbrood, sacbrood (1) and paralysis have all been observed; American foulbrood has not yet been recorded. In order to prevent its introduction a law has been passed prohibiting the importation of bees, honey and wax (2).

(1) See R. April 1913, No. 398. (Ed.)

(2) See R. Jan. 1912, No. 3. (Ed.)

196 — **Value of Formaline Vapour as a Disinfectant in Apiculture, Especially in Combating Foul Brood** (1). — BORCHERT, A., in *Berliner Tierärztliche Wochenschrift*, Year XXXIII, No. 46, pp 547-549, bibliography of 5 works Berlin, November, 1921.

The experiments made by the author for the purpose of determining the efficacy of formaline in the control of foul-brood have shown that the action of formaline vapour saturated with water vapour cannot be considered as satisfactory.

Honey-combs infected with the spores of bacteria and with micro-organisms in the vegetative state (*Bacillus alvei* Watson-Cheyne and Cheshire, *Bac. alvei* Krompecker, *Bac. megaterium*, *Bac. pyocyaneus* and *Bac. prodigius*), as well as cultures of bacteria in test-tubes were treated, but it was found that the formaline vapour only penetrates into small spaces with a narrow opening in such minute quantities that it was impossible to be sure of its destructive action.

Thus honey-combs infected with foul-brood cannot be rendered safe by the use of formaline, and treatment with formaline vapour cannot be substituted for MASSEN's method (2) which consists in destroying the pathogenic germs by melting the contaminated combs in a steam cerificator.

#### FISH BREEDING

197 — **Fresh Water Pisciculture in North Africa.** — RIVIÈRE, C. H., in *Revue Agricole de l'Afrique du Nord*, Year XIX, No 125, pp 931-934 Algiers, December, 1921

The species of fish found in the fresh or brackish waters of North Africa are few in number, and with 2 or 3 exceptions, of little importance from the point of view of food. Among the latter are the following:

1) A trout, *Salax macrostigma*, rare and only found in the mountainous region of Kabylia, Collo, Bougie and Babors, where the water is cold and clear owing to the altitude and the sheltering. This fish lives on rocky bottoms and dislikes mud, and at present has little value as an article of food.

2) The Eel, this fish, which is found frequently enough to be sometimes sold on the markets, is of good quality when taken from clear water, especially if it has abundant food. The author reared eels in the Experiment Garden at Algiers putting some of them into muddy water with little food, and others into clear water with a regular supply of food; he obtained heavier fish with better flesh by the latter method.

3) The Carp. This fish appears to have been imported to Constantine in 1857, when 40 young carp were sent with other fish by the Acclimatisation Society and put into the pond at Djebel-Ouach, where they multiplied. A certain number of Tench were introduced at the same time. Ten years later all the fish in the pond were caught: there were 307 carp from 18

(1) Aus dem Laboratorium für die Erforschung und Bekämpfung der Bienenkrankheiten an der Biologischen Reichsanstalt für Land und Forstwirtschaft in Berlin-Dahlem

(2) MASSEN, über die unter dem Namen "Paulbrut" bekannten seuchenhaften Brutkrankungen der Honigbiene, in *Mitteilungen aus des Kaiserlichen Biologischen Anstalt für Land- und Forstwirtschaft*, Heft 7, 2te Auflage, 1909

By the same author, Weitere Mitteilungen ueber Bienenkrankheiten und ihre Bekämpfung *Indem*, Heft 17, 1919 (Author's note)

to 45 centimetres long and 4 tench of 34 cm., as well as numerous fry of both species.

4) The Barbel, very common, two varieties being found: *Barbus cattensis* and *B. setifensis*. These fish are as a rule very thin, and more or less flavourless. They are very plentiful in the rivers of Morocco.

From the point of view of food value, none of the other species are of any importance, no matter what their surroundings may be. The Chromis is a fish with the flavour of the Perch, but it never attains a large size, and as it lives in the depths of the Sahara, could never be brought to market.

The following are all too small and too rare to have any culinary value: *Gobius*, *Cristiceps*, *Cyprinidon*, *Gasterosteus brachycentrus*, and *Tellia apoda*; the same remark applies also to the rather larger *Leuciscus callensis*, an insipid fish only found in the East of Algeria.

Some species seem to have been introduced with a view to acclimatisation in Algeria, this was probably the case with the *Carrassius* or Cyprin, which was found in certain rivers of West Algeria long before the French occupation.

Without any undue confidence in the future of pisciculture in North Africa which is poor in clear, deep waters of good quality, it might perhaps be worth while to make some experiments in breeding, were it only for the purpose of increasing even to a small extent the food supply of certain regions, especially of those at some distance from the sea. East Morocco, with its abundant supply of pure water, could provide by means of its reservoirs of irrigation water and its barrages, excellent fish-ponds situated at different altitudes, while some of the rivers and streams would become stocked by the fry that must necessarily escape from confinement.

Carp and tench could be reared in the quieter waters of the lower reaches of the rivers or in lakes and ponds, as long as care was taken to avoid those whose waters contain large quantities of sea-salt, or calcareous salts. Transport would not be an unsurmountable obstacle in the way of stocking the waters with these two Cyprinidae, for they are strong fish and travel well.

Suitable surroundings for trout are not so easy to find, and the species is more difficult to propagate, as fertilised eggs must be obtained for transport. Thus although the Kabyle trout would almost certainly become acclimatised in Morocco, to obtain and transport fertilised eggs would present serious difficulties.

In default of this species, it would seem advisable to introduce the fry of the Californian trout (*Salmo irideus*), as these have already been tried with success.

198 - Coccids of *Cottus Gobio* and of Carp Fry. — I. GAUTHIER, M., in *Comptes rendus de l'Académie des Sciences*, Vol. 175, No. 16, pp. 671-674, figs. 6. Paris, October 16, 1921. — II. LÉGER, L. and STANKOVITCH, *Ibidem*, No. 17, pp. 742-744. October 24, 1921.

I. The author's investigations were undertaken with the object of determining whether a connection exists between the Coccids of sea and fresh-water fish of the same family. He examined the "Miller's Thumb",

*Cottus gobio* L., a species which, so far as he knew, had never been recorded as suffering from these parasites.

The experiments carried out at the Grenoble Piscicultural Laboratory revealed the presence, in specimens of *C. gobio* from the basin of the Isère, of two species of tetrasporous coccidia (genus *Eimeria*), occurring either singly or together in the same host, but differing, from the type attacking the sea-form of *Cottus*. To the one species, which is characterised by its ovoid spores provided with a beak at one extremity, the author gave the name *Eimeria cotti*, the other which is a little larger and has ovoid biconical spores, alike at both poles, and often disposed in the form of a cross, he called *Eimeria piraudi*.

The author frequently found *Eimeria cotti* associated with *Eimeria piraudi* in the epithelium of the pyloric caecum and intestines of individuals of *C. gobi* coming from the Furon and the lower Isère. *Eimeria piraudi* had only been observed in the form of oocysts in the digestive tract of *Cottus* caught in the Isère in the neighbourhood of Grenoble. The oocysts are spherical, or slightly ovoid, and vary in size from 11 to 13  $\mu$ .

Of the two forms of *Cottus* coccidia, only *Eimeria cotti*, a specialised type with a tubular process at one pole, is entirely different from the other coccidia at present known to occur in fresh-water fish.

A study of the phylogeny of the 2 species shows that in all probability *E. cotti* is a primary parasite of *Cottus* whereas *E. piraudi*, an insignificant form of a type which is very common in fresh-water fish, would appear to be a secondary parasite connected with the adaptation of the genus *Cottus* to fresh-water conditions of life.

II. — In certain of the carp-breeding ponds of the South-East, the very young fry are often attacked by a coccid which completes its entire life-cycle within the epithelium of the intestine, where it multiplies to such an extent as to destroy the mucous membrane lining in some places, and cause a serious often fatal enteritis which greatly endanger the breeding prospects, for the fry that survive remain thin and weakly and their normal growth is arrested.

The authors describe the parasite, which is a new species, and suggest for it the name of *Eimeria carpelli* n. sp.

The fact that the same individuals harbour the parasite in all stages of development (the multiplication being both endogenous and exogenous), shows there is no intermediate host, the young fry becoming infected by the spores ejected into the water by diseased individuals. Hence the malady could be prevented by hatching and rearing the carp in ponds that have previously been drained dry.

The breeding-fish should be placed as late as possible in the pond, that is to say not before the temperature is suitable for egg laying and care must be taken to remove them as soon as possible after oviposition.

DUBISCH's method, which consists in frequently moving the fry from one pond to another (each pond having been previously kept dry until needed), has the additional advantage of providing the fish with surroundings entirely free from the germs of infection, and thus protecting them from the

intestinal forms of coccidiosis which, even when not fatal, hinder the growth of their hosts. In this manner, other factors being equal, the maximum quantitative and qualitative yield would be obtained.

## FARM ENGINEERING.

- 199 - **Harvesting Sugar Cane by Machinery Advantages of the "Luce Sugar Cane Harvester"**. — *The Louisiana Planter and Sugar Manufacturer*, Vol. LXVII, No. 25, pp. 396-398, pl. 4, diagr. 1. New Orleans, Dec. 17, 1921.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

Experiments with the LUCE sugar cane harvester were first started in 1900-1901 and have continued steadily for the last 20 years with a view to perfecting the present standard machine. The present model is now considered a practical, commercial machine, which will do the required work in such a way that the benefits derived from its use, all things considered, are sufficient, when represented in money values, to pay the interest charges or purchase price, the cost of working and the amortisation charges and still leave enough over to represent a fair net return on the initial investment.

Certain varying conditions encountered in different localities would affect the actual saving in cost per ton of cane harvested, e. g. the length of rows which has a direct bearing on the daily capacity of the harvester. The effect is shown graphically on the accompanying chart of curves. These curves also indicate the fact that the weight of cane per unit of area has also a direct bearing on the capacity and cost. For cane amounting to 20 tons per acre and in 1000 ft. rows, the capacity of the machine is approximately 16  $\frac{1}{4}$  tons per hour at cost of about 26 cents per ton. For this reason it is difficult to state exactly the cost per ton of cutting cane with this harvester, though it is evident that the cost is decidedly lower than with hand labour.

Another distinctly advantageous point lies in the fact that this machine gives a uniformly lower bottom cutting superior to that made by hand cutting, as the hand cutters invariably leave small stumps of cane in the fields. The bottom cutters of the LUCE harvester operate underneath the trash mat and cut the stalks off clean and square just at or below ground level. Besides leaving the stubble in excellent condition for the next crop, the yield is increased appreciably by the addition of from 2 to 4 in. of length to every stalk in the field. Careful experiments to determine the amount of the actual increase showed that the tonnage is increased by over 5 %. As this increase lies in the lower portion of the stalk, where the sucrose content per unit of weight is highest, the result is an increase in actual sugar yield per acre up about 8 %. It is estimated that the total amount of cane from a plantation, being say 25 000 tons from hand cutting, with a yield of 10 % would give 2 500 tons of sugar. With harvesters the increase in sugar yield (8 %) would be 200 tons. With sugar at 2  $\frac{1}{2}$  cents per lb. the actual money value of this increase of \$10 000.

Each stalk is handled individually and carried through the machine by steel conveyor chains, is topped at the last ripe joint, regardless of the

length of the stalk, and thoroughly stripped of leaves and trash before delivery at the rear. Delivery can be made direct into a trailer which dumps the cane in regular piles on the ground or is transferred to mill or cane hoist without entailing any hand labour . . .

The preparation of fields for the use of harvesters is neither expensive nor difficult, but necessary requisites are straight, long rows free from stumps and stones, while spacing should be sufficiently wide to avoid stooling entanglement with the machine, etc. Trash on the ground presents no difficulty, and may be as thick as 10-12 in. Leaning or blown cane is handled by these harvesters as effectively as clean, erect cane. The separator plough divides the row which is being worked from the one adjacent "and the pick-up fingers" lift the stalks to a substantially vertical position before the cutters reach the base.

200 - **Apple Packing Houses in the North Western Districts of the United States.** — PAILTHORP, P. R. (Investigator in Marketing of Fruits and Vegetables) and SAMSON, H. W., (Specialist in Standardisation), in *Farmer's Bulletin* No. 1204, United States Department of Agriculture, pp 3-39, figs. 26. Washington, D. C., June, 1921.

Description of the community packing houses, operated either by co-operative associations or by individuals in the apple-growing districts of the Northwest. The percentage of the crop packed in community houses is increasing steadily and estimates show that the amount increased from about  $\frac{1}{4}$  of the total crop in 1916 to approximately  $\frac{1}{2}$  of the crop in 1919. The same basic principles of construction and equipment are applicable to all types of houses and the equipment and methods of operation in the larger community houses are suitable to a large extent for use in the ranch houses.

This bulletin deals with the details of construction, arrangement, equipment and operations from the time of receiving the fruit for packing to their storage or putting on rail, and is based on a study of the methods and practices which have given the greatest satisfaction commercially. The figures illustrate the various points in construction including also grading belts, packing tables and stands, and suggested arrangements for gravity conveyors, elevators, chests, etc. An interesting packing floor plan shows the method employed in a well arranged community packing-house.

Fig. I here appended, shows the popular type of machine used for sizing boxed apples, and Fig. II, two types of lidding presses recommended.

The machines shewn in Fig. I, are 6 ft. 2 in. wide and vary from 30 to 52 ft. in length, depending upon the capacity. The smallest model is equipped with 8 bins and the largest with 48. They are provided either with a canvas sorting belt or with a roller sorting belt regulated by a lever operated by the head sorter. Opinions differ as to the relative merits of the two types of sorting belts. The sizing unit separates the fruit into 3 grades, each of which is delivered into a separate set of bins. The endless carrier

shown in the Fig. is composed of a series of cross rods carried forward by 2 side chains, and from these are swung canvas-bottomed carrying cups. The cups are held in a horizontal position by the supporting prongs which

*Apple Sorting Machine.*

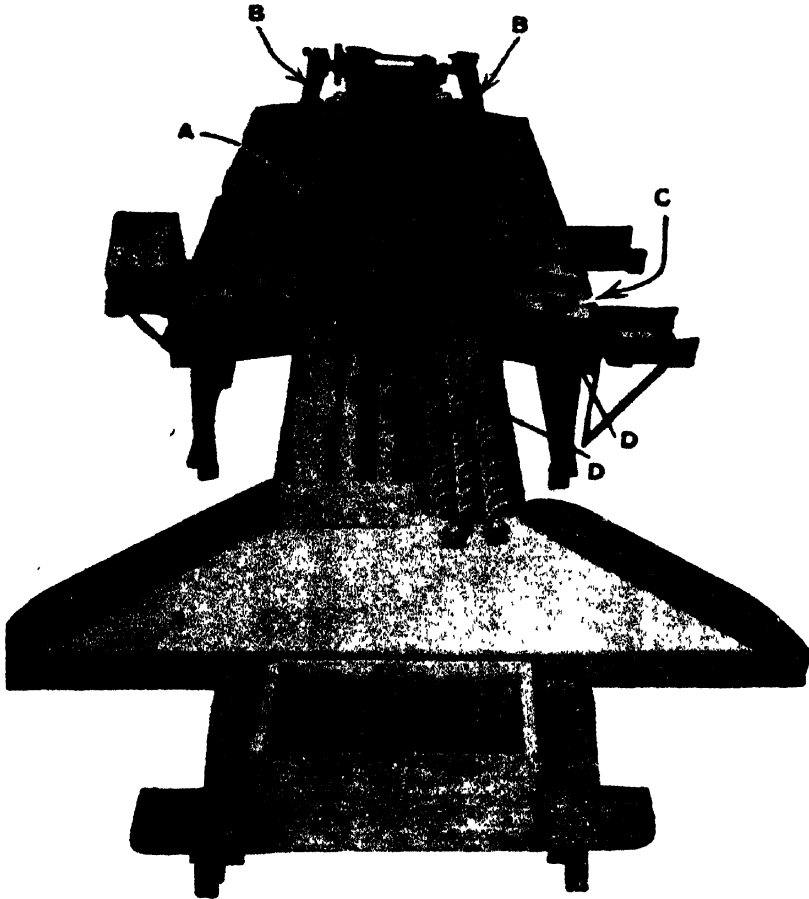


FIG. 1. — EXPLANATION :

- A = Sizing apparatus.
- B = Sorting belt.
- C = The Shaker.
- D = Detachable plates for the belt.

slide along the iron side rails. Over each bin there is an opening in the side rails which is bridged by the inner bars of simple balancing scales. At the opposite end of the scale are canvas pockets into which the standard size

apples are placed. All that is necessary in order to make the machine ready to work is to place an apple of the desired size in the pocket of the scale, as the fruit delivered to the bin will correspond in size to the regulating apples. The cups of the carrier receive the apples, and as they move forward the supporting prongs at the sides of these cups pass in turn over the inner bar

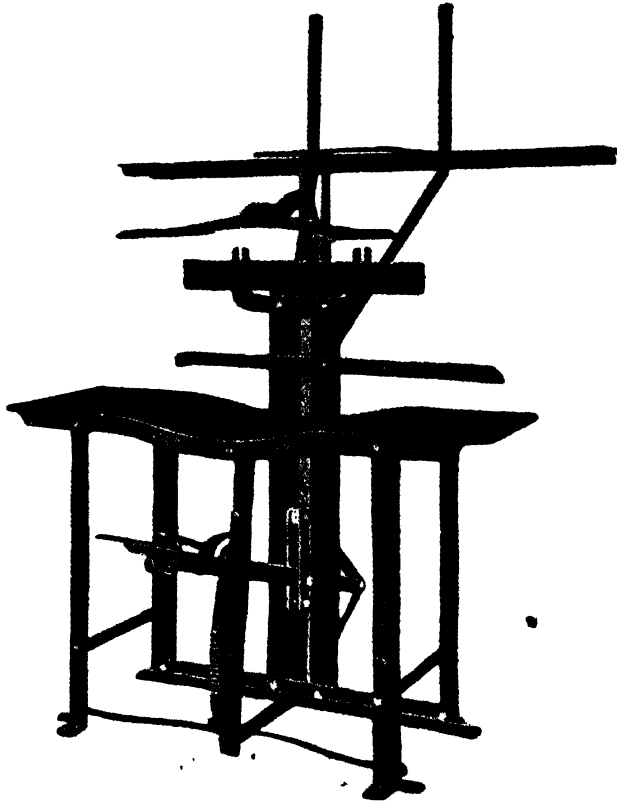


FIG. 2 — Press for fixing the covers.

of each scale until one is reached which is counterbalanced by a regulating apple that is slightly lighter than the apple in the carrying cup. The inner bar of the scale is then depressed slightly, allowing the supporting prongs to pass through the opening in the side rail and causing the rear end of the carrying cup to lower gradually, thus delivering the fruit to the loops of webbing which are provided to break the fall of the fruit into the bin below.

With respect to Figs. II and III, the author states that a properly packed box should have a bulge of  $1\frac{1}{2}$  in. in the centre but tapering so that the apples in the ends are flush with the top. After lidding the bulge is distributed equally between the top and bottom.



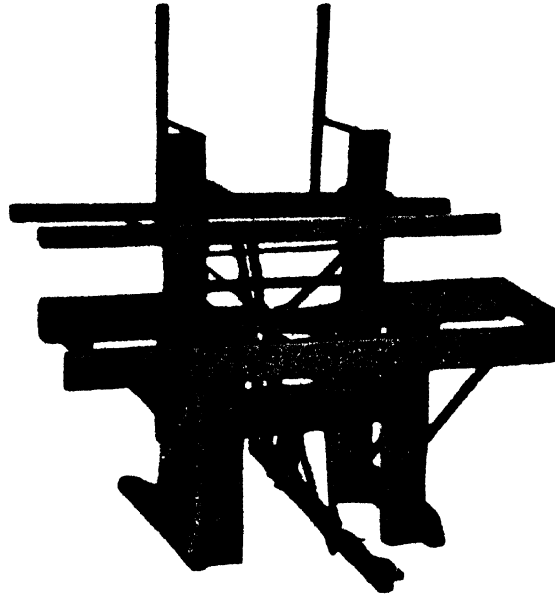


FIG. 3 — Press for fixing the covers.

[200]

201 - **Flue-Curing Tobacco Barns and Packing House.** — JENNINGS, A. C. (Government Irrigation Engineer), in *The Rhodesia Agricultural Journal*, Vol XVIII, No. 5, pp. 529-533, Plans 3. Salisbury, October, 1921.

In consequence of the increased acreage under Virginian Tobacco and the possible need for more flue-curing barns, details of the most approved type of barns and packing house are here given, the plans and specifications given previously in the *Rhodesia Departmental Bulletin*, No. 334 dated Oct. 1919 being now cancelled. The accompanying drawings have been prepared under the advice of H. W. TAYLOR, Government Tobacco Expert.

The details given include specifications as to site, arrangement of buildings, foundations, walls, openings, roofs, furnaces and flues, ventilators and tiers.

As regards the packing house, the details specified for the barns may be applied, except where otherwise stated. A description is also added of the conditioning cellar built below ground-level under the packing house.

The plans illustrate 1) a block of flue-curing barns; 2) half elevation of back of barn; 3) half sectional elevation on centre line; 4) section through furnace, packing house, section elevations and plan.

A list is given of the materials required for a block of 4 drying barns (quantity, lengths or size. etc.), and also for the packing house.

[200-201]

## AGRICULTURAL INDUSTRIES.

INDUSTRIES  
DEPENDENT  
UPON ANIMAL  
PRODUCTS

202 - **The Practical Organisation of Milk Control in Belgium.** — *Bulletin de la Commission permanente du lait*, August-September 1921, pp. 70. Brussels.

The Permanent Milk Commission gives in this Bulletin a summary of the discussions that took place between the members of the Commission appointed to consider the question of the practical control of milk. At the meeting on July 7 1921, the following resolutions were unanimously passed by the members present.

"The Permanent Milk Commission after a through and careful study of the practical measures to be adopted for the organisation of milk control in order to insure the purity and hygienic condition of milk which plays so important a part in the preservation of public health, has come to the following conclusions:

1) It is most desirable that Public Administrations and Agricultural Societies should increase and encourage cow-shed competitions. It would be well to resume the keeping of Herdbooks.

2) All milk control should be founded upon the veterinary inspection of cowsheds and milch cows, in accordance with the royal decree based on the findings of the Permanent Milk Commission

The Permanent Milk Commission is further of opinion:

a) that with the assistance and under the supervision of the Public Authorities, a group of milk producers should be formed of which the members should voluntarily subject their cows and cowsheds to inspection. The milk of these cows should be tested from the hygienic, chemical and bacteriological standpoints. The producer of pure, wholesome milk should receive remuneration for this control, and this remuneration should be adequate and of a public character.

b) that the Governing bodies, both official and private, of hospitals, crèches and day-nurseries, etc., should forbid the use in their institutions of all untested milk, or of any milk coming from dairy-farms where the premises are not subjected at least to veterinary inspection.

c) that the above mentioned institutions should be provided with the plant necessary for keeping milk fresh and in good condition."

203 - **A Method for Detecting the Admixture of Goats' Milk to the Milk of Cows.** — AUSTEN, W., in *Deutsche Schlacht- und Viehhof Zeitung*, Year XX1, No. 25, p. 211. Berlin, 1921.

This method is based upon the fact that the casein of cow's milk is completely dissolved by ammonia, whereas the casein of goat's milk is insoluble in ammonia (1).

(1) See *R. March* 1916, No. 342. Another method has been described by A. GABOTHULER (*Zeitschrift für Untersuchung des Nahrungs- und Genussmittel*, Vol. 32, Part. 10, p. 453, Berlin, 1916). Goats' milk coagulates when subjected to the alcohol test, even if the degree of acidity is below 8. Milk with ordinary sediment and with a degree of acidity below 8, may be suspected of containing goat's milk if a precipitate is formed on the application of the alcohol test. The admixture of 30 % is easily detected. By a double alcohol test, the

This method does not give any practical values unless the milk is normal, that is to say, fresh. In order to keep milk fresh, bichromate of potassium is used instead of formaldehyde, which modifies the casein to the point of rendering it insoluble in ammonia, even after boiling.

The milk for the test should be as fresh as possible and free from all fat. The skimming is effected in the GERBER tubes generally used for determining the fat content, but they are closed at both ends with indiarubber stoppers. The fat that accumulated during centrifugation (temperature of milk 50° C) in the narrow portion of the GERBER tube is extracted by means of a glass tube attached to the sides. The 20 cc. of milk thus treated are heated in a water-bath at 50-60° C, then 2 cc. of 25 % ammonia are added and the mixture is kept at this temperature for half-an-hour, care being taken to shake it from time to time. The tubes are next placed in the centrifugator with the graduated part turned towards the periphery, and centrifugated for some minutes at the rate of 1200 revolutions per minute.

This method gives dependable results in the case of cow's milk which has been adulterated with goat's milk, provided 20 % of the latter is present: below 20 % the results are uncertain. As the qualitative test had given very good results, the author tried to apply it in determining the amount of goat's milk in the mixture. Cow's milk, with the addition of respectively 20 — 30 — 40 — 50 — 60 % of goat's milk, was skimmed, 2 cc.

addition of 10 % can be determined. With the alizarol test, woman's milk becomes violet, goat's milk brownish-yellow and cow's milk a lilac-red. In the reaction to neutral red suggested by MORO, woman's milk turns yellowish red, goat's milk orange, and cow's milk red. By their reaction in the presence of Nile blue sulphate, woman's milk (white) can be distinguished from cow's milk (blue) and goat's milk pale blue. With the ammonia test proposed by U. UMKOFF, woman's milk assumes a colour varying from pink to violet; the casein of goat's milk swells, whereas that of woman's milk and of cow's milk dissolves. In U. TUGENDREICH'S nitrate of silver reaction, woman's milk becomes a coffee-brown without coagulating; goat's and cow's milk coagulate and the coagulum turns brown later. STEINEGGER'S ammonia method combined with a centrifugal process makes it possible to detect even 3 parts of goat's milk in 100 parts of cow's milk.

There is on this subject another study by PRITZLER (*Ibidem*, p. 453-454). The method proposed by STEINEGGER (*Landwirtschaftliches Jahrbuch der Schweiz*, 1903, p. 233 and 1904, p. 221) has been modified by PRITZLER in so far that instead of reaction tubes, SCHMID'S albuminometer is used. About 22 cc. of milk are centrifugated for 5 to 10 minutes at a velocity of 1400 revolutions per minute; the layer of fat is separated; 2 cc. of concentrated ammonia are added to the skimmed milk in the test tubes and the latter are shaken; they are then kept for half-an-hour in a water-bath at 45° C, and centrifugated for 3 minutes at 1400 revolutions per minute after which: in the case of pure goat's milk, there is a deposit of 8-12 cc.; in mixtures of equal parts of goat's and of sheep's milk, there is a deposit of 4-5 cc.; in a mixture containing 30 % of goat's milk, the deposit is about 3 cc.; when there is 20-15 %, the deposit is 2.1 cc. and with an admixture of 10-5 %, from 1 to 0.4 cc. Sometimes, no deposit is formed when the milk is 24 hours old, but coagulation takes place in the addition of 1/1000 of formaldehyde. Goat's milk, when treated with formaldehyde, behaves in the same manner whether 60 hours old or quite fresh. Cow's milk gives no precipitate after 60 hours on being treated with formaldehyde. (*Ed.*)

of 25 % ammonia added, and the mixture after heating in the water-bath was centrifugated for 10 minutes at a very high speed.

The precipitates in the GERBER tube were very well defined, and on being repeatedly measured, gave figures in the following table.

*Volume (in cc.) of the precipitate obtained in different milks.*

Proportion of goat's milk in the mixtures					Pure goat's milk
20 %	30 %	40 %	50 %	60 %	
0.6 cc.	1.2 cc.	1.6 cc.	2.0 cc.	—	5.6 cc.
0.6	1.1	1.6	2.1	3.1 cc.	5.5
—	1.0	1.4	2.0	—	5.5
0.5	0.9	1.5	2.2	—	—
—	1.0	1.6	2.3	3.2	6.2
0.4	—	2.0	—	3.1	—
—	1.4	—	—	3.2	—
0.5	—	—	2.2	—	—
—	0.9	1.7	2.3	3.3	—
<i>Averages</i> .0.5	1.1	1.6	2.1	3.1	5.7

Admixtures of 70 — 80 — 90 % of goat's milk gave very variable results. In mixtures containing from 20 to 50 % of goats' milk, every additional 10 % of goat's milk could be determined from an increase of about 0.6 cc. in the precipitate.

204 — **A Theoretical and Practical Study of the Ensilage of Forage Plants and of the Adaptation of the Process to the Requirement of Argentina.** — SCASSO, J. M., Ministerio de Agricultura, División de Investigaciones agrícolas y Estudios especiales *Ensilage*, p. 420, figs. 53. Buenos-Aires 1920.

This work, which is principally intended for practical stock-breeders, gives an exhaustive description of the different ways of ensilaging forages and the qualities of the silage obtained, particularly from the point of view of the special conditions of stock-breeding in Argentina. This is the criterion according to which the advantages and disadvantages of each type of silo in the different districts are discussed, the choice in each individual case being based upon local requirements.

The theoretical principles of ensilage are also stated, in order to serve as a guide for the handling of the forage treated. The practice of feeding stock on ensilage is taken into consideration and different rations and many subjects suitable for experiment are suggested. The economic factor receives due attention in a special chapter, and finally the author describes the plants most suited for ensilage, and studies their several possibilities, advantages and disadvantages.

The author especially recommends the use of ensilaged fodder in the feeding of young steers; he rates its value below that of fresh grass and above that of hay. Under the existing conditions in Argentina, more than 45

to 50% of the dry matter of grass is lost in hay-making, whereas under the most unfavourable circumstances not more than 25 % is lost during ensilage. Further, one ton of hay in the rick costs 6 to 7 pesos, but one ton of silage only costs from 2.7 to 3.7 pesos.

The plants most suited for ensilage in Argentina are lucerne, maize and sorghum. It would be worth trying in addition clovers, Hungarian "Moka", the "teosinte" (*Euchlaena luxurians*) and the sunflower. In districts where it flourishes, lucerne is always the best plant for ensilage (the native variety which is not infected with *Cuscuta* should be chosen); on clay soils, sulla can very well be planted instead of lucerne. Maize should only be given the preference where it is cultivated intensively, and already acclimatised varieties must be chosen such as "amarillo canario", "colorado de Baradero", "piamontés", etc. Recourse may be had to sorghum in the dry northern and western zones, where the best varieties appear to be the Sudanese, "Kafir Standard", and sugar sorghum. Wheat, barley and oats should only be ensilaged when drought or locusts threaten the grain production. Lucerne suits all types of silo, while maize is most adapted to cylindrical forms built above ground.

If lucerne and maize are ensilaged together, the most satisfactory proportions are 2 parts of lucerne to 1 of maize, i. it has not headed, or 10 of lucerne to one of maize, if bearing half-ripe cobs. Should the farmer have any molasses at his disposal, excellent results are obtained by ensilaging 15 parts of lucerne and 1 of molasses.

A perfect product results from the ensilage of unchopped lucerne. Maize can be put whole into the silo, though chopped maize gives better results, but it is expensive and works out to about 2 pesos per ton (1 paper peso = 2.20 fr. at par). Should a forage-chopper be bought for the purpose, one should be chosen with a large return and spiral rather than with flat blades. A forage-chopper cutting up one ton an hour requires a 23 HP engine.

Salt is not necessary, but if used, 1 kg. to 1.5 kg. is added per cubic metre.

The author reckons that after deducting the cultivation expenses of the lucerne and maize, plus the cost of cutting and transport to the silo, 1 ton of lucerne by the time it reaches the silo costs 1.40 pesos in Argentina; the cost of maize per ton being 2.59 pesos if cut by machine; 2.72 pesos if cut by hand and 1.74 pesos if cut by the maize reaper-and-binder. One ton of available forage (that is to say after deducting the losses sustained during ensilage), costs according to the silo used:

1) *pit silo*: lucerne: 3.68 pesos, if ensilaged unchopped; 5.46 pesos, if chopped; whole maize, 5.46-5.63 — 4.31 pesos, according to whether it is cut with a reaper, a hay-sickle or a binder-reaper; as for chopped maize, the first quality costs 6.86 pesos and the inferior quality, 5.85 pesos.

2) *Stack-silo covered with soil, or kept in position by weights*: cost of lucerne 2.69 pesos; of maize 4.34 pesos or 3.22 pesos, according to whether it is cut by a reaper, or a binder-reaper (for this type of silo, only unchopped forage is used);

3) a good-sized, wooden cylindrical silo constructed above ground : unchopped lucerne 7.01 pesos ; chopped lucerne 8.77 pesos ; chopped maize cut with a reaper 10.08 pesos, chopped maize cut with a binder-reaper 9.15 pesos (maize used in cylindrical silos above ground must always be chopped) ;

4) *Reinforced-concrete silo* : chopped or unchopped lucerne 6.53 or 4.77 pesos respectively : chopped maize 7.84, or 6.91 pesos, according to whether it was cut with a reaper, or with a binder-reaper ;

5) *Reinforced-masonry silo* : chopped or unchopped lucerne 6.31 or 4.55 pesos ; chopped maize 7.62, or 5.69 pesos, according to whether it was cut with a reaper, or a binder-reaper.

The most economical kind is unchopped lucerne silage made in a silo-stack. This type should always be made where extensive cultivation is practised.

Stock ought not to be exclusively fed on ensilaged forage as to give them nothing else is neither economical nor wholesome. In case of necessity, however, animals while being fattened may be given this food alone, if no hay or concentrates can be obtained. No better food exists for milch cows that are permanently housed than 15 to 20 kg. of ensilaged forage, per head and per day, with the addition of concentrates. If these consist of linseed cake mixed with grain, not more than 0.5 kg. per head and per day should be fed.

There is no proof that a diet of ensilaged forage causes abortion in females in an advanced stage of pregnancy. To prevent the milk acquiring the smell of the forage, all that is necessary is to remove the milk-pails from the shed as soon as the cows are milked.

The second part of the work contains the answers given by the different agriculturists to a form of questions distributed by the Division of Agricultural Research and of Special Studies of the Ministry of Agriculture of Argentina. It appears from the replies given that ensilage met with general approval wherever it was used.

205 - **Storage of Potatoes, Comparative Effects of Light and Darkness.** — MATRAS, A'. in *Journal d'Agriculture Pratique*, Year 85. Vol. II, No. 50, pp. 498-499. Paris, Dec. 17, 1921.

As a result of the statement made by NORFE to the effect that it is more advantageous to store potatoes in darkness than exposed to the light, conditions otherwise being equal, PAROW made comparative experiments with the object of elucidating this question. The details of his work are given in NAGEL's report in the *Zeitschrift für Spiritus-Industrie*, Berlin. The following résumé is here made by the author.

Two lots of potatoes, of absolutely identical character, weighing 5 kg. each, were placed in a cool (9° C) dry open spot on January 11, 1918 and allowed to remain there until July 22. One of these lots was placed in an open case and consequently was exposed to light, the other was placed in a closed case, i. e. in darkness.

The potatoes were weighed and analysed at the beginning and end of the experiment and from the reports made, the following results are distinctly worthy of note.

After 6 months storage	Open case	Closed case
	%	%
Loss on gross weight of tubers . . . . .	17.20	14.00
Loss of starchy content of potatoes . . . . .	21.86	15.25
Loss of sugar content of potatoes . . . . .	80.00	60.00

It is already recognised that the loss in dry matter from tubers stored in a cellar or silo from the beginning of the germination period (end of the winter) is greater than the loss resulting solely from respiration. On the contrary, light retards germination and may assist in restricting the loss of starch content which accompanies the process and results from the formation of diastases; darkness is on the other hand, useful previous to germination, that is to say, it acts only as a contradictory element as regards the losses provoked by respiratory phenomena.

Contradictory results have hitherto been obtained through not making a sufficiently clear distinction between diastatic and respiratory phenomena.

206 - **Transport of Market Produce by Aeroplane.** — JAUMAIN, E., in *Revue horticole belge*, Year 2, No. 12, pp. 169-170. Huy, Dec. 1, 1921.

The author states that where it is possible to utilise an aeroplane service for the carriage of produce as at London, Paris, Brussels, Amsterdam, this form of transport is superior to the railway for high priced flowers such as orchids, lilies, roses, etc. Although the cost of air transport is comparatively high, it is certain that the flowers will reach their destination fresh and undamaged and that consequently they, will fetch a higher price.

At the present time an air service for goods has been established between Brussels, Rotterdam, Amsterdam, Paris and London: the journey from Brussels to Rotterdam takes 1 hour 10 minutes; from Rotterdam to Amsterdam, 30 minutes; from Brussels to London, 3 hours 30 minutes.

## PLANT DISEASES

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

#### RESISTANT PLANTS

207 - **Forms of Hop Resistant to Mildew (*Sphaerotheca Stumuli*)** (1). — SALMON, F. S., in *The Annals of Applied Biology*, Vol. VIII, Nos. 3-4, pp. 146-163. Cambridge, Nov. 1921.

The wild hop (*Humulus Lupulus* L.) is composed of a number of forms which show distinctive physiological and constitutional characters.

One of these characters is the grade of susceptibility to the attack of the hop mildew (*Sphaerotheca Humuli*); these characters vary from extreme susceptibility shown both in the open and under greenhouse conditions, to a high degree of resistance in the open, and complete immunity in the greenhouse, with intermediate grades. Out of 291 ♀ seedlings examined, 165, or 56.70 % showed extreme susceptibility, while 18, or 6.19 % were "commercially resistant". The remainder fall into intermediate groups. Out of 480 seedlings, ♂ and ♀, 27, or 5.63 % were completely immune, and 7, or 1.46 % semi-immune under greenhouse conditions.

As a general rule, seedlings immune under greenhouse conditions conserve their high degree of resistance in the open.

208 - **Red Currant Varieties comparatively Resistant to American Gooseberry Mildew (*Sphaerotheca mors-uvae*) in England.** — SALMON, F. S., and WORMALL, H., in *The Gardener's Chronicle* (Third Series), Vol. LXX, No. 1804, p. 47, figs. 1. London, July 23, 1921.

In the fruit plantations at Wye College (Kent), in 1921, an unusually virulent outbreak of American Gooseberry Mildew (*Sphaerotheca mors-uvae*) on the gooseberry bushes (*Ribes Grossularia*) was followed by the appearance of this mildew on certain varieties of red currants (*R. rubrum*). In a border where Allington Pippin apples are interplanted with red currants, the young shoots of some of the currant bushes were seen on June 26 to be affected with mildew (*Sph. mors. uvae*). The effect was easily noticeable as the mildewed leaves curled somewhat so as to show the under surface on which large white, powdery patches of mildew were prominent. Further examination showed the presence of the brown, scurf-like patches of the perithecial stage of the mildew on the young stem and the young green berry.

(1) See also R. Febr. 1918, No. 232. (Ed.)



Investigation showed that only certain of the red currant bushes in this border were attacked. About 90 % of the border consisted of "Fay's Prolific", but the bushes attacked were clearly not of this variety, but rogues of various types, and some were probably "Raby Castle". The affected bushes were interplanted with "Fay's Prolific" which remained immune.

Another part of the same plantations gave equally convincing evidence of the resistance of "Fay's Prolific" to this mildew. A group of "Raby Castle" bushes were growing near a group of "Fay's Prolific". Here again all the "Fay's Prolific" bushes were quite free from attack, while the "Raby Castle" bushes immediately adjoining were badly affected.

The economic importance of the occurrence of the American Gooseberry Mildew in the red currant lies in the fact that the winter stage (carrying the winter spores or ascospores) occurs on the leaves, and is not confined as is usually the case with the gooseberry, to the stem. Where red currants adjoin (a gooseberry plantation, there is a danger of early outbreaks of this mildew on the latter, due to the presence in the soil of spores conveyed by red currant leaves. Affected shoots of red currant should be cut off and burnt before the leaves fall.

209 - **The Efficacy of Fungicidal Dusts for the Control of Wheat Smut (*Tilletia Tritici*)** (1). — MORETTINI, A., in *Le Stazioni sperimentali agrarie italiane*, Vol. LIV, Parts 7-10, pp. 293-315. Modena, 1921.

MEANS  
OF  
CONTROL

Prophylactic experiments against wheat smut (*Tilletia Tritici*) have been carried out since 1920 at the Casalina Agriculturists' Section of the "R. Istituto superiore agrario sperimentale" of Perugia. The object of these experiments was to test the efficacy of the time-honoured copper sulphate treatment as compared with the dry or powder method. In addition to the copper sulphate dust, "polvere Caffaro" was also used. The physical character and chemical composition of this powder seem likely to produce good results. By way of experiment the Caffaro powder was mixed with water in the proportions of 1 and  $\frac{1}{2}$  %. Its reaction being slightly acid renders superfluous the second lime-milk bath in the case of wheat seed that has been already treated by the fungicide. In the control copper-sulphate treatment, a  $\frac{1}{2}$  % solution of  $\text{Cu SO}_4$  was used. The grain was immersed for 15 minutes, and then immediately neutralised with milk of lime. After treatment the seeds were left to dry in the usual-manner.

The powder treatment was carried out in glass balls with a capacity of 500 cc. in which the diseased wheat was placed together with the necessary amount of the fungicide and shaken for 3 or 4 minutes.

Both the copper carbonate dust and the "polvere Caffaro" were used in doses increasing from 2 to 15  $\frac{0}{100}$ . With 2  $\frac{0}{100}$  of copper carbonate there remained, after shaking for 3 to 4 minutes only slight traces of the

(1) See also R. April 1921, No. 419. (Ed.)

fungicide, but with larger amounts the residuum increased in proportion to the ‰, even after the seed had been repeatedly immersed. With "polvere Caffaro" the residuum exceeded 3 ‰. Although this powder is impalpable like the copper sulphate dust, it adheres much more closely to the seeds. Naturally the adherence of the two fungicides, when they are equally fine, depends upon the variety of wheat and its hygrometric condition. Some of the seed was treated 20 days before sowing, and the rest on the day it was put in the ground. A sample of each lot of seed was taken, in order to determine its germinating capacity immediately after treatment, and at the end of some months. The same measures were adopted in the case of the seed treated with copper sulphate and "polvere Caffaro" (after soaking in water), and the results of the two fungicides were compared.

The wheat used in every case was the hybrid Passerini which had been sorted by machine and contained some crushed and damaged seeds.

In the first series of experiments the wheat was thickly dusted with the spores of *Till. Tritici*, so that the whole mass was of a brownish colour. Practically it would be difficult, if not impossible, to meet with seed infected to this extent, for the mechanical processes of winnowing and sorting partially clean the caryopsids. The experiment was, however, useful from the research standpoint.

In a second series of experiments the wheat was infected with fewer spores and the conditions more nearly resembled those that actually exist under ordinary conditions.

The principal points to be determined were : 1) the effect of the fungicides upon the germinating capacity and energy of the seed ; 2) their effect upon wheat smut ; 3) their influence on yield.

The following conclusions were drawn from these experiments :

1) The usual treatment with  $\frac{1}{2}$  % copper sulphate which consisted in soaking the seeds in the solution for 15 minutes and removing the acidity of the copper sulphate by means of lime, has no perceptibly injurious effect upon germinating power or energy.

2) The application of powder, whether copper sulphate dust, or "polvere Caffaro") in the proportions of 2 to 6 ‰ had the same effect upon the germinating power of the wheat. Other factors being equal, the germination was improved.

3) In the case of wheat seeds that have been intentionally and excessively infected with the spores of *Till. tritici*, treatment for 15 minutes with a  $\frac{1}{2}$  % solution of copper sulphate is more efficacious in destroying the fungus, than the application of 2 — 4 — 6 ‰ of copper carbonate or "polvere Caffaro". The same applies to the strong doses, viz, those from 10 to 15 ‰.

4) On the other hand, where the wheat was less infected, though to a degree much exceeding any infection that could occur naturally, the dusting treatment is most efficacious ; 3 ‰ carbonate of copper having a greater effect on the fungus than spraying with copper sulphate, while 4 ‰ "polvere Caffaro" is slightly less efficacious.

5) "Polvere Caffaro" used in the proportion of 4 ‰ is a little less active than copper carbonate, but does all that is required.

6) Dusting, whether with copper carbonate, or "polvere Caffaro" is equally efficacious, if done on the day of sowing; it has no injurious action even if carried out eight months previously.

7) "Polvere Caffaro" mixed with water in the proportion of ½ % and applied for 15 minutes behaves like a similar solution of copper sulphate and renders superfluous any neutralising treatment with lime.

As regards the practical carrying out of the dusting treatment, whether copper sulphate or "polvere Caffaro" are used, the success achieved on a small scale by mixing the infected seed and the fungicide in little glass balls would seem to show that good results might be obtained with some adaptation of ordinary movable churns or similar apparatus, or even of simpler and cheaper appliances. The churn should be three-quarters filled with wheat and the fungicide, so that a few turns of the machine are enough to mix them thoroughly. Such an apparatus can be worked by machinery like the sorters used in the mechanical sorting of seeds. In the case of small quantities of wheat, use can be made of little barrels containing less than 1 hectolitre and with an opening allowing the wheat to be quickly introduced and removed. The wheat and the fungicide can be thoroughly mixed by simply rolling the barrel.

The author is, however, of opinion that further experiments are required, both for determining the efficacy of fungicidal dust in preventing the attacks of *Till. tritici*, and for testing the best apparatus for carrying out the treatment.

210 — **Stem-Rust Infection in Wheat in North-Dakota U. S.** — See No. 159 of this Review.

211 — ***Phyllosticta Montemartinii* n. sp., a Deuteromycete Injurious to the, *Loganiacea Buddleia variabilis*, in Italy.** — CIFEIRI, R., in *Rivista di Patologia vegetale*, Year XI, Nos. 9 and 10, pp. 114-115. Pavia, December 29, 1921.

DISEASES  
OF VARIOUS  
CROPS

In the neighbourhood of Macerata, three young specimens of *Buddleia variabilis* — a *Loganiacea* hitherto only grown in gardens as an ornamental shrub, but recently recommended for cultivation because of the signal service it renders to apiculture on account of its long flowering season and the wealth of its floral nectaries — were found at the beginning of the summer of 1921, to be suffering from fungus attack. Small, irregular patches of a yellowish-red colour and surrounded by a narrow whitish halo were observed on the leaves, and especially on their edges. Later, there appeared, on the infected part of the leaf-blade, the fructifications of a fungus regarded by the author as the pathogenetic agent described by him under the name of *Phyllosticta Montemartinii* n. sp. The diseased patches subsequently withered and became detached, leaving the leaf riddled with holes. At the end of the summer the leaves died and fell so that the shrubs became prematurely defoliated.

Spraying with Bordeaux mixture should be tried as a preventive and curative measure.

212 - *Fusarium cubense*, a Hyphomycete Injurious to the Banana in Porto Rico. — See No. 277 of this Review.

213 - *Colletotrichum Kaki* n. sp., a Deuteromycete Injurious to *Diospyros Kaki* var. *Kiombo*, in Italy. — MAFFEI L., in *Rivista di Patologia vegetale*, Year XI, Nos. 9 and 10, pp. 116-118. Pavia, December 29, 1921.

A specimen of *Diospyros Kaki* var. *Kiombo* growing in the Botanic Garden at Pavia has suffered since 1919 from a characteristic disease manifesting itself in the form of small patches nearly always occurring on the edges or at the tips of leaves, but occasionally found on the blade, whence they spread towards the centre and cover a great part of the surface of the leaf. The portion attacked withers and breaks, and finally the whole leaf falls. The spots which are of a more or less deep shade of hazel brown, are dotted about the healthy portion of the leaf, and stand out from the vivid green of its surface giving it a contorted warty appearance.

As the patches increase in size, they present concentric striae. In the end the spreading spots become confluent, affecting a large part of the blade and sometimes even covering it entirely.

Upon these affected patches on the upper surface of the leaf, numerous small pustules make their appearance, which when fully grown, are visible to the naked eye and are the fructifications of the pathogenetic fungus. The author speaks of the disease by the popular name of "macchie fogliari del kaki" (leaf-spots of the kaki), and describes the fungus as a species new to science, under the name of *Colletotrichum Kaki*.

214 - The Oak Oidium on the Chestnut Tree in Emilia, Italy (1). — MANARESI, A., in *Le Stazioni sperimentali agrarie italiane*, Vol. LIV, Parts 7-10, pp. 289-292. Modena, 1921.

During the second half of July 1921, many young chestnut seedlings, which had been sown the previous spring in the forest nursery of Bombiana, in the Commune of Gaggio Montano (Prov. of Bologna), were found to have their leaves, and also sometimes their stems attacked by a fungus that was identified as being without any doubt *Oidium quercinum* Thüm., a very common parasite of the oak, and occurring in the neighbourhood of the nursery on the young oak buds.

The presence of oak oidium on the chestnut tree had been reported in France in 1908, and observed in other parts of Italy besides Emilia, viz., in the vicinity of Savona, Prov. of Genoa (1909), near lake Nemi, Prov. of Rome (1915), as well as in the neighbourhood of Vittorio Veneto, Prov. of Treviso (1915), but in no previous case had young individuals been attacked.

In 1911, the parasite was again discovered on strongly growing chestnut cuttings at Zocca, Prov. of Modena, towards the end of August, and at Fontanelice, Prov. of Bologna, at the end of September.

(1) See also R. Feb. 1920, No. 264; R. Sept. 1920, No. 922; R. May 1921, No. 568. (Ed.)

According to the author, it is most probable that the parasite overwinters in the buds of the young host-plant, in which case it would be in a position when the spring came to infect the new shoots.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

- 215 - **Artificial Production of "Tipburn" of Potatoes** (1). — FENTON, F. A., and RESSLER I. L., in *Science*, New Series, Vol. LV, No. 1411, p. 54. Utica, N. Y., Jan. 17, 1922.

GENERAL

Experiments conducted at the Iowa Experiment Station have shown that the Rhynchote *Empoasca mali* (potato leaf-hopper) is the factor concerned with the production of "tipburn" or "hopperburn" of the potato. Emulsions were made by crushing a large number of adults of both sexes in water and small quantities injected into the leaves of potato plants; in a few days the injury was apparent, similar to, if not identical with "tipburn." Difficulty was experienced in introducing large amounts of the emulsion into the leaf tissue, but enough was injected to induce the change. When the emulsion was placed on the leaf and the tissue pricked with a fine needle negative results were obtained. Emulsions made from crushed nymphs failed to cause damage except in a few cases, and even then it was not pronounced.

That these insects contain some toxic substance was further demonstrated by placing the residue left over from the insects after the emulsion had been poured off on leaf petioles and then inoculated by means of a fine scalpel. In every case a lesion was produced, the tissue at these points first turning yellow and then brown. Later the cells collapsed, leaving a fairly large scar.

Although Bordeaux mixture is toxic to the nymphs, it acts comparatively slowly so that by keeping a leaf sprayed with this compound colonised by live nymphs, "tipburn" was produced. This would appear to show that Bordeaux mixture does not prevent "tipburn" by its action on the leaf but rather by its action on the insect.

- 216 - ***Howardula benigna*, n. gen. and n. sp., a Nematode Parasite of *Diabrotica vittata*, *D. trivittata* and *D. 12-punctata*, in the United States.** — COBB, N. A., in *Science*, New Series, Vol. LV, No. 1409, pp. 667-670, figs. 4. Lancaster, Pa. December 30, 1921.

MEANS  
OF  
CONTROL

This article gives a description of the Nematode, *Howardula benigna* Cobb, n. gen. and n. sp. which is common in the body-cavity (abdomen, thorax and also the head) of the cucumber beetles *Diabrotica vittata*, *D. trivittata* and *D. 12-punctata*, especially the first. The nematode infests the two sexes of its host about equally.

The new parasite of *Diabrotica* spp. was first discovered at Marietta, Ohio, but subsequent study of its geographical distribution has shown that in 1921, it was probably co-extensive with the distribution of its main hosts *D. vittata* and *D. trivittata*.

(1) See R. July 1911, No. 2295. (Ed.)

About 1500 individuals of *D. vittata* were examined ; they came from different states of the North-American Confederation (Ohio, Illinois, Maryland, Michigan, Massachusetts, Virginia, Iowa, Mississippi, Montana, Texas, Minnesota, Louisiana, North Carolina, Connecticut, Alabama) and also from Canada (Nova Scotia and Ontario).

The nematism is often high and affects on an average 20 % (0 % — 70 %) of the beetles. The insects which come from a locality where they are not attacked by the Nematode are larger and more vigorous. Anatomical evidence shows the infested female beetles to be less fertile than the non-infested. In none of the numerous lots of beetles examined was the rate of infestation by any other animal-parasite as high as by *Howardula*, with the single exception of a 43 % dipterous infestation, but no note was made of degrees of phyto-infestation. As many as thirteen thousand Nematode larvae have been removed from the body-cavity of a single *Diabrotica vittata* and no doubt the number may go yet higher. On several occasions 20 or more adult specimens of *H. benigna* have been taken from a single beetle. Theoretically these should produce some forty thousand larvae or more. The older female beetles, when attacked by the Nematode, deposit a few to upwards of fifty of the nematode larvae with each egg. The grubs soon mature on the eggs or in the soil (where they can live several weeks), moult, develop a more perfect spear, and by its aid begin to make their way into the body-cavity of the beetle-larvae soon after the latter hatch out. It is rather improbable that the Nematodes enter their host by way of the mouth and alimentary canal.

217 — ***Oriolus luteolus*, A Bird Useful to Agriculture in India.** — FLETCHER, T. B. and INGLIS, C. M. in *The Agricultural Journal of India*, Vol. XVI, Part. 3, pp. 231-234, 1 coloured plate. Calcutta, 1921.

*Oriolus luteolus* (the Indian Black-Headed Oriole), has long been known in Indian ornithological literature under the name of *O. melanocephalus*.

In India it is strictly arboreal in its habits and rarely seen on the ground ; it lives chiefly on fruit and the small insects on the leaves and stems.

C. W. MASON examined the stomachs of twenty-three of these birds at Pusa, and found that seventeen of them had fed on wild fig fruits ; the stomachs of five contained nothing else. The stomachs of the 18 birds which had fed on insects contained ninety-five, of which four were classed as beneficial kinds, seventy-three as injurious, and eighteen as neutral. Five birds had eaten insects only. In the Central Provinces, E. A. D'ABREU found a Pyralid caterpillar and a *Ficus* fruit in the stomach of one Blackheaded Oriole on January 24, 1914. At Pusa, the authors watched the Oriole feeding on a mass of mealy-bug clustered on the stem of a wild vine growing on *Dalbergia Sissoo*. So far as agriculture is concerned, therefore, this bird may be considered as beneficial. *O. luteolus* has never

(1) See R. July 1911, No. 2295. (Ed)

been seen to attack cultivated fruits. This bird is protected throughout the year in Bombay, the United Provinces, Bihar and Orissa, Bengal, Assam, Burma, Madras and Mysore.

218 - **The Use of Crystalline Ferrocyanide of Potassium as an Insecticide** (1). —

RAYBAUD, I., in *Comptes rendus hebdomadaires de la Société de Biologie*, Vol. LXXXV, No. 33, pp. 935-937. Paris, 1921.

The author has investigated the effect produced upon the scale-insect *Ceroplastes rusci*, a common parasite of the fig-tree in Provence, by potassium ferro-cyanide applied for two consecutive years according to the method adopted in California since 1914 by SANFORD (2).

In February the author selected figtrees with a diameter at man's height from the ground, of 0.15 to 0.30 m., and made in their trunks a tubular cavity with a lumen of 0.01 to 0.03 m. and varying in depth from 0.06 m. to 0.15 m. In the case of some of the trees, the cavity was filled with the cyanide, in others it was left empty; the orifice however was always hermetically closed with a cork or wooden plug. A bluish liquid was seen to exude from the wound, when the cavity had been filled with ferro-cyanide, but not otherwise. Some of the branches of the trees containing the cyanide had been affected, and any leaves they already bore were destroyed a few days after the operation. The buds withered, and dried up completely, in the following year, while the branches themselves assumed the appearance of dead wood. Any scale-insects that still remained on them had also perished, though those on the other parts of the tree seemed in no wise affected. All the branches of the fig-trees in which the cavity was left empty were perfectly healthy. Thus the death of the branches was clearly due to the action of the potassium ferro-cyanide, and the trees appear to have reacted in some way to this toxic effect by producing the coloured liquid which exuded from the wounds.

The author then applied the same treatment to other species: *Pinus pinea*, *P. sylvestris* and privet (*Ligustrum*). These did not appear to suffer in any way though a very small quantity of the bluish liquid (resinous in the case of the conifers) was observed to flow from the wound. Two of the pines which were covered with caterpillars were not freed from these pests, and none of the insects were found dead near the tree trunks, although the last year the experiment was made just at the time the caterpillars appeared.

Without in any way casting doubts upon the results obtained by SANFORD who experimented upon other trees and other species of parasites, the author states that: 1) crystalline potassium ferro-cyanide is injurious when introduced into the trunk of the fig-tree; 2) *P. pinea*, *P. sylvestris* and privet all seem to resist its toxic action; 3) no toxic effect appeared to be exerted upon the caterpillars on the trees treated. Whether or not the scale-insects of the fig-tree were affected is a matter of

(1) See R. Feb. 1915, No. 235; R. Oct. 1915, No. 1103; R. May 1916, No. 596. (Ed.)

(2) See R. Feb. 1915, No. 235. (Ed.)

little importance, seeing that the parts of the tree where the scale-insects perished were themselves destroyed.

The author considers that the toxic effect of potassium ferro-cyanide is increased in the fig-tree by the presence of laticiferous tubes, which are absent in the trees which were able to resist the poison. He intends to make further experiments with the object of clearing up this point.

**219 - Experiments in the Control of the Olive-Fly (*Dacus Oleae*) by Means of the Lotrionte System of Traps ("capanette dachicide"), in Spain and Italy (1). —**

I. AGUILÓ Y GORSOT, J., in *Revista del Instituto Agrícola Catalán de San Isidro*, Year LXX, Part. II, pp. 213-215. Barcelona, Nov. 1921. — II. MARINUCCI, M., in *La Nuova Agricoltura del Lazio*, Year IX, No. 214, pp. 143-144. Rome, December 1, 1921.

I. — In 1921, the campaign against the Olive Fly (*Dacus oleae*), was carried out with great energy in the Province of Tarragona, Spain.

The control method preferred at Samá Park at Cambrils, was Lotrionte's "Capanette dachicide" system. These "Capanette" are small shelters made of tin, or preferably of galvanised iron, bent into one or two ridges, and containing a little bundle of twigs sprayed with a poisonous mixture. At Cambrils this method was adopted for two thousand olive trees, the roof of the trap being made of uralite.

A gang of workers was first of all formed to make the bundles of twigs and suspend them with wire beneath each "capanetta". By June 20, each tree was provided with a trap and the spraying with insecticide began.

In the formula used honey was an excellent substitute for molasses, no difference in the inherent value of the mixture being caused by the change. As the sweetening power of honey is greater than that of molasses, 14 % less of honey than molasses is required. The formula used at Samá Park was as follows: water 57 litres, honey 18 kg., borate of soda 1 kg., boric acid 1 kg., arsenate of soda 1 kg.

The insecticide is sprayed upon the twigs fixed to the trees beneath their "capanetta", by means of an ordinary knapsack-sprayer used for vines. A man can treat over two hundred trees per hour, and with 13 litres of the insecticide (the capacity of the sprayer) he sprays 215 "capanette", i. e. 215 trees. On the 8<sup>th</sup>, 18<sup>th</sup> and 20<sup>th</sup> of July, August and September the twigs were sprayed a second time; they were treated twice only in October, viz., on the 8<sup>th</sup> and 28<sup>th</sup>.

This experiment proved that the adoption of the Lotrionte method entirely protected the olive-trees of Samá Park from the attacks of the "fly". In point of fact, however, owing to the meteorological conditions obtaining in 1921, the season was not a favourable one for the increase of the parasite. Still, the Samá trees were free from attack, whereas those on other estates where the same system had been negligently carried out, or wholly omitted, suffered from the Olive-Fly to a small extent.

(1) See also R. July 1911, No. 2369; R. March 1913, No. 323. (Ed.)



The cost of spraying is as follows :

2000 "capannette" . . . . .	940 <i>pesetas</i>
affixing capannette to trees . . . . .	150 "
130 kg. of insecticide. . . . .	75 "
Wages paid for spraying . . . . .	15 "

The cost price of the substances used for the spray were : honey, 2 *pesetas* per kg., borate and arsenate of soda, 2.50 *pesetas* per kg., boric acid, 4.50 *pesetas* per kg.

As the "capannette" when once fixed on the trees, last for some years and the depreciation extends over five years, the cost per olive tree may be estimated at about 0.11 *pesetas* per annum. This also includes the cost of the wire used for suspending the traps from the trees. Thus in the case of 2000 olive-trees, the outlay according to the above figures, would be :

Depreciation of the "capannette" and wire and fixing of the same . . . . .	220 <i>pesetas</i>
1300 kg. of poison mixture . . . . .	750 "
Wages paid for control work . . . . .	150 "

The cost per 100 trees would thus be 56 *pesetas*, and if 20 % is subtracted for the increased price obtained for the fruit, the outlay per tree would be reduced to 45 *pesetas*, or 0.45 *pesetas* per tree.

The prices quoted above for the insecticide are a little higher than the normal ; it is clear, that, if the ingredients had been bought in large quantities by agricultural syndicates, or official institutions, and distributed to the agriculturists, the expense could have been reduced 20, or 25, %.

II. — Report on the results obtained in Italy in the control of the Olive fly by the Lotrionte method.

This work was begun in 1921 in the experimental olive yard of the "R. Scuola pratica d'agricoltura" of Rome (farm of S. Alessio in the Campagna Romana).

In 1921, Prof. Lotrionte wished to try a better poison mixture and also a new type of "capannetta" of a very simple kind, made of strands of reeds bound solidly together with string. The insecticide is directly applied to the inner surface of the bell-shaped "capannetta" to which it adheres better owing to the larger surface presented by the numerous projecting courses of the material. Such a "capannetta", which can last well for two years, is cheaper than the original type with a tin roof, and offers two distinct advantages : it does not get heated by the sun and thus provides a more agreeable refuge for the "fly" ; it excites less suspicion in the insects which alight even on the outside of the trap, for which reason the exterior also should be sprayed a little each time when the interior is treated.

These "capannette" are easily sprayed with an ordinary sprayer with intermittent action.

The insecticide remains in excellent condition for over twenty days on the surface of the "capannette", because it is very hygroscopic and

viscous, and contains no putrescent substances of which the odour would serve to repel instead of attracting the "fly".

The experiment was carried out on 700 average-sized trees (average diameter of foliage 5 m.), belonging to the College experimental oliveyard, and on 300 other trees in the neighbourhood, which were all that remained of olive-yards that were in course of being abandoned.

Only 700 "capannette" were used and none were affixed to small trees or specimens without fruit. Several control olive-yards were employed, these lay to the North-West, North-East and South-West respectively. The first (Lazio farm), contained a little over 200 trees, the second (Torlonia vineyard) had over 400, but both were about one kilometre from the experimental ground. The third, a larger oliveyard with over 1000 trees belonging to the Cecchignola farm, was about two kilometres distant. In the other directions there were no olive-trees within at least three kilometres. The zone treated was thus well isolated. The special Lotrionte mixture was applied four times to the "capannette" at the following periods: 1) June 30-July 2 (it took three days to attach the "capannetta" to each tree, for this was done by two of the college pupils during the afternoon hours set apart for field-work); 2) July 25-26; 3) September 12; 4) October 4-5.

Between the middle of July and the end of August, two sprayings of acid Bordeaux mixture were also given for the control of "Occhio di pavone dell'olivo" (*Cycloconium oleaginum*).

The insecticide used in this experiment was composed of: 50 % glucose; 2 % glycerine; 2 % boric acid; 2 % borate of soda; 2 % arsenite of potash; 2 % extract of Gorgonzola. Prof. LOTRIONTE is trying other less costly and more deadly formulae, and will make them known as soon as his researches and the experiments which he is carrying out are completed.

On November 10, a Commission was formed consisting of Professors B. GRASSI, Director of the Institute of Comparative Anatomy of the Royal University of Rome, and of the annexed Laboratory of Agricultural Entomology; A. MANGO, Royal Inspector of the Diseases of Plants, and M. MARINUCCI, in his two-fold capacity of Director of the "R. Scuola pratica d'agricoltura" of Rome and representative of the "Società nazionale degli olivicoltori".

According to the statements in the report of the Commissioners, the fruits of all the trees in the zone treated (experimental olive-yard), were fine and free from injury, except for the bruises caused by the hail of September 22. It is noticeable that this observation applied as much to olive-trees with large fruit containing a quantity of juicy pulp and to the "ros-ciola" variety, which has small olives that are soft and juicy, and hence very liable to the attacks of the "fly", like other varieties with average sized or small olives.

Samples were taken from many trees of different varieties growing in the zone treated and from these an average sample was made. This when examined on the spot, gave the following results: perfectly healthy olives

free from the "fly", 95 %; olives attacked by *Dacus oleae* 2 %. The Commission also noted that the pulp of the few olives attacked was as a rule but little affected, so that it could still yield much oil of a good quality. Few of the fruits had fallen, and even those on the ground were found to be free from the insect.

In the first control olive-yard visited (the Torlonia vineyard), the Commission immediately found the trees to be severely infested, especially those bearing large and medium-sized fruits, 90 to 100 % of which were attacked. From 30 to 40 % of the very small fruits of the "olivastri" (seedling trees that have not been grafted) harboured the pest, although they are usually left untouched or slightly injured, either because they gave little pulp, or on account of their late ripening. Samples were also taken from many varieties of trees in this control olive-yard, and an average sample made, which on being examined in Rome at Prof. GRASSI's laboratory, gave the following results: sound olives 23 %; olives attacked by the "fly" 77 %. The observations made in this oliveyard together with the results of the laboratory examination of the sample of olives gathered, showed that: 1) The few olives that were not attacked by the "fly" grew on "olivastri" and other kinds of olive-tree with small late-ripening fruits: 2) the infection in the case of trees with large and average fruits was never below 90 %; 3) the pulp of olives infested by *Dacus oleae* was, for the most part eaten away and much damaged, so that it yielded only a little oil of poor quality.

The sample of olives taken from the control olive-yard at the Lazio farm was examined by Prof. GRASSI with the following results: sound olives 1 %; olives attacked by the "fly", 99 %.

The olives gathered in the third control olive-yard (Cecchignola farm), were also found by Prof. GRASSI to be seriously attacked by the pest. No percentage was however calculated, as the crop was rather small and all produced by "olivastri".

The very high proportion of infected fruit on the Lazio farm is partly attributable to the small yield of the trees, which had borne a heavy crop the preceding year. The pulp of these olives was so much destroyed that only a little oil of bad quality could be obtained.

As a result of their observations and the data collected, the Commission concluded their report with the statement, that the experiment made in 1921 at the experiment olive-yard of the "R. Scuola pratica d'agricoltura" of Rome had been most successful and that without doubt the system of control adopted is as efficacious as it is practical.

220 - **The Potato-Tuber Moth (*Phthorimaea operculella*), in the Department of Hérault (1).** — LICHTENSTEIN, J., and GRASSE, P., in *Bulletin de la Société entomologique de France*, No. 18, pp. 267-268. Paris, 1921.

The author considers that the potato-tuber moth (*Phthorimaea operculella*, Zeller), found its way into Drôme and Hérault through consign-

INSECTS, ETC.  
INJURIOUS  
TO VARIOUS  
CROPS

(1) See also R. January 1920, Nos. 54 and 150; R. May 1920, No. 609; R. April 1921, No. 443. (Es.)

ments of infected potatoes. Potatoes containing the larvae of the moth were actually observed on the market at Montpellier, but the origin of the vegetable could not be exactly determined. Further, all the stored potatoes from a consignment coming from Montpellier itself were found to be infested. The moths were just emerging, for the authors saw some of them flying in the garden. Potatoes are not cultivated on an extensive scale in the district of Montpellier, but a certain number are grown by local gardeners, and large stocks coming from different regions are stored to supply the town. From the imported potatoes the moth could therefore easily penetrate into those parts of the Department where farm crops of these vegetables are raised. Hence, it is most important that its first appearance should at once be reported, and the infected tubers either destroyed, or covered with sand in order to prevent the emergence of the moth.

221 - *Ceroplastes* sp., a Scale-Insect Injurious to the Maté (*Ilex paraguariensis*), in the State of Paraná, Brazil. — Chacaras e Quintaes, Year XII, Vol. XXV, No 6, pp. 467-468, fig. 1. São Paulo, December 15, 1921.

Among scale-insects lately reported as harmful, one new species has so far not been specifically determined: it belongs to the genus *Ceroplastes* and was discovered in the State of Paraná, where it attacks the maté (*Ilex paraguariensis*).

The branches and leaves of the host-plant assume a blackish colour, and the leaves, especially on their upper and the edges of their lower surfaces, are covered with black, apparently sooty, powder formed by the mycelium and fructifications of a Perisporiaceae (sooty mould), the growth of which is encouraged by the secretions of the scale-insects that adhere to the branches of the tree.

The following formulae are most commonly employed in the control of *Ceroplastes*:

1) black soap, 500 gm.; crude petroleum, 8 litres; water, 4 litres to be used for as a spray.

2) paraffin, 500 gm., vegetable oil of any kind, 800 gm.; ordinary soap, 1 kg.; water, 4 litres to be applied directly with a brush, or used as a spray.

Another treatment consists in cleaning the infected parts of the plant with soap, or tobacco extract, applied by means of a coconut brush or metal glove.

As the scale-insects increase with great rapidity, it is advisable to take the following precautions:

- 1) To keep the plantations as clean as possible;
- 2) To remove and burn all infected trees.

222 - *Lochmaea sanguinolenta*, a Coleopteron Injurious to the Melon in Catalonia, Spain. — AGUILÓ, J. in *Agricultura*, Year V, No. 15, pp. 354-355, fig. 1. Barcelona, 1921.

In September 1920, a whole crop of melons in the Province of Tarragona was completely destroyed by the Coleopteron, *Lochmaea sanguinolenta* Fabr., which had not previously been reported as injurious to *Cucumis Melo*.

The beetle devours the shoots and leaves of the plants while still quite young thus arresting the growth of the seedlings, which succumb to its persistent attacks. The few plants that survive are weakly and bear very few melons, which are of small size and acid flavour. *L. sanguinolenta* also frequently deposits its eggs on the leaves of its host, and as the larvae when hatched live entirely on the subterranean portions of the melon, the plants soon perish.

The following formula has proved efficacious in the control of the insect : 400 gm. of arsenate of sodium anhydride containing 60 % arsenic acid, 1 hectolitre of water, and 1 kg. slaked lime. Two sprayings at an interval of 5 or 6 days are sufficient.

223 - *Xylostodoris luteolus*, a Rhynchote Injurious to the Palm *Oreodoxa regia* in Florida. -- MOZNETTE, G. F., in *The Quarterly Bulletin of the State Plant Board of Florida*, Vol VI, No. 1, pp 10-15, pl. 3. Gainesville, Florida, October 1921.

The presence of a Rhynchote causing great injury to the palm *Oreodoxa regia* has been recently reported from South Florida. The insect was described for the first time in October 1920, under the name of *Xylostodoris luteolus* Barber, from specimens collected at Santiago de las Vegas (Cuba), where the pest also does great damage to the same palm.

In March 1920 the author received from Coconut Grove (Florida), portions of leaves of *O. regia* that had been seriously injured by an insect which he recognised as *Xyl. luteolus*. This is the first time that the rhynchote has been reported as occurring in the United States.

The insect attacks only the young and tenderest segments of the leaves of the top of the tree and of any rachis that is not unfurled. Since it shuns the light, it abandons the leaves as they begin to develop. A white spot forms on the leaf-segment attacked, after the puncture made by the Rhynchote in order to extract the plant juices upon which it lives. The spots increase in number and coalesce and the injured portion of each segment turns brown and dies.

The palm therefore soon assumes a very unsightly appearance.

After making many preliminary control experiments on small specimens of *O. regia*, living in the open and infested with the parasite, the author found that a mixture of one part of 40 % sulphate of nicotine in 1200 parts of water gave excellent results, for it killed the insect without doing any perceptible injury to the young growing tissues of the palm. Some fish-oil soap was added to this mixture (2 kg. being introduced into a receptacle having a capacity of 450 litres). A subsequent investigation of the palms that had been sprayed showed that 75 % of the insects succumbed to the first application. A second treatment was effected a week later which practically freed the palms from the insects, so that the trees began to put forth new, vigorous, healthy and handsome leaf-segments.

224 - Insects Injurious to the Banana in Porto Rico. — See No. 177 of this Review

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INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

FIRST PART  
ORIGINAL ARTICLES

**The Mycoplasma Theory.  
Its Scientific Importance and Practical Significance.**

by

Prof. JAKOB ERIKSSON  
Stockholm.

A. — THE RUSTS OF CEREALS.

a) *The Usual Opinion as to their Origin and Propagation.*

The terrible injury caused by rust to the oat crop in Sweden in 1889, entailing a loss estimated at 16 million crowns, caused the Swedish Government in 1890 to allocate a special sum (10 000 crowns) for a further and thorough investigation of this disease. The work was entrusted to the Botanical Institute of the Royal Agricultural College at Experimental fältet near Stockholm. The experiments were to be carried on for three years under the direction of the author. Observations were made even during the preliminary investigations that were not in accordance with the generally-received opinion, according to which the origin and spread of the fungus are due solely to the spores of fungi (uredospores, teleutospores and aecidiospores), occurring in the neighbourhood. Moreover, these observations which were based on the facts mentioned later, proved without any doubt that these fungi existed under another evolutionary form.

Let us first recall the *studies made in the open* in wheat-fields, on grass land and in forests. The most striking results were obtained in the experiment field, in small plots, usually 3 m × 3 m, in which were grown year after year, many (300-400) varieties of rye, wheat, barley, oats and certain forage Gramineae, the seeds coming from different parts of Sweden and abroad. The growth of these plants was followed every year without

interruption and with the greatest attention from sowing to harvest. The *first appearance of the pustules* of the different forms of rust was especially noted and also the manner and *intensity of their development*. Every week or fortnight and in some cases every day, similar observations were made. These studies gave important and unexpected results. The date of the appearance of the pustules belonging to the same species of rust varied considerably with the different cereals, and often even on the several lines or kinds of the same cereal, and upon sowings made at different times, although the seedlings might be growing side by side. The difference in the time of the outbreak of the same type of rust, such as black rust (*Uredo graminis*), was especially striking in the autumn and spring-forms of the same cereal. e. g. wheat, although these varieties were only a few metres apart.

At the same time that these observations were being made in the experiment field, very extensive *infection experiments* were carried out in the greenhouse. It was found that when growing in the experiment field rye attacked by black rust was unable to transmit this disease to either wheat or oats, even if cultivated side by side with them. Thus the forms of black rust affecting various cereals would not appear to be absolutely the same. In the morphological species of *Puccinia graminis*, several biological races or specialised forms (*formae speciales*, f. sp.) are to be recognised; amongst these are found (in Sweden): 1) f. sp. *Secalis* on rye and barley as well as on certain other gramineae (*Triticum repens*, *Elymus arenarius*, etc.), 2) f. sp. *avenae*, on oats and some other gramineae (*Dactylis glomerata*, *Alopecurus pratensis*, etc.), and 3) f. sp. *Tritici*, on wheat and occasionally attacking very slightly rye, barley and oats. Mention cannot here be made of the specialised forms of certain species of the genera *Aira*, *Agrotis*, *Poa*, etc.

It must, however, be admitted that the infection cultures made in the greenhouse did not explain all the unexpected results obtained in the experiment field. This is especially the case as regards the *late appearance* in summer and autumn of the *primary pustules* of various kinds of rust. The first pustules of black rust are seen — not counting outbreaks occurring in the immediate neighbourhood on the barberry — on autumn cereals in the middle of July, that is to say at least 9 to 10 weeks after the thawing of the plants which have over-wintered, and a week to a fortnight later, on spring cereals viz., 10 weeks after sowing.

It was observed at the same time that the primary rust pustules only made their appearance at the moment when the growth of the host-plant was nearly finished.

The differences in the first appearance and the vital force of the same form of rust in different years, were also remarkable and not easy to explain. An attempt was made to account for then by the dissimilar meteorological conditions existing during these years, but without success.

The fact that in the case of certain forms of rust — for instance *Uredo glumarum* — the *uredospore production was enormous*, whereas the germinating and infecting capacity of these spores were as a rule very slight, capri-



cious, and without any apparent effect upon the spread of the disease, also remained an inexplicable phenomenon.

All these observations taken together led the author to look for another source of the appearance and propagation of the disease viz., a disease germ present in the plant itself.

b) *Latent and Plasmic Life of the Fungi.*

"Die Getreideroste" (Stockholm) was published in 1896 and contained all the chief results of the new experiments that had been obtained up to the summer of 1894. Throughout the book, runs like a red thread, the idea of an internal disease-germ inherited from the mother-plant and in many cases causing the outbreak of the disease. This view was stated publicly and definitely for the first time, at the Annual Meeting of the Agricultural Academy of Sweden, on January 28, 1897, and was repeated subsequently at the "Académie des Sciences" of Paris on March 1, and at the German Botanical Society at Berlin on the 24<sup>th</sup> the same month.

The author had sought in vain to prove by microscopic investigation the presence of those internal disease-germs. He certainly discovered in the peripheral tissue of wheat seeds that had been shrivelled and deformed by yellow rust, a well-developed mycelium and sometimes even clusters of winter spores, but all attempts to find a mycelium in the embryo itself while still enclosed within the seed, or in the seedling, continued fruitless. It was only towards the time when the spots of rust began to appear, 4-8 weeks after sowing, that a mycelium of this character was to be discovered, and even then, it occurred only in the immediate neighbourhood of the spots.

The author then put forward the bold hypothesis that the fungus had hitherto led a latent plasmatic life within the protoplasm of the host, living with it in a state of symbiosis to which the author gave the name of *Mycoplasma*. At a certain time and under the influence of external agents, these two intimately united plants separate, and an intercellular mycelium which produces visible pustules of rust soon makes its appearance.

In the work "*Sur l'origine et la propagation de la rouille des céréales par la semence*" (*Ann. Sc. Nat.*, Paris, Ser. 8, Vol. 14-15, 1900-1901), a large number of experiments in support of the new theory are described. The author, however, not being entirely satisfied with the results of the isolated cultures made from 1892 to 1898, of which a detailed account is given in the book, and realising that insurmountable difficulties might lie in the way of the solution of the problem by means of pure cultures made in special boxes and protected from external germs of disease, decided to employ the modern cytological methods of fixing, mounting and staining certain parts of the organs attacked. At this time the author had the good fortune to have as his collaborator G. FISCHLER, now professor of Botany at Hohenheim (Württemberg) with whom the experiments were carried out in common during 1902 and 1903, and later by the author alone. The results of these

investigations are published in the series "Über das vegetative Leben der Getreiderostpilze (I-IV *K. Vet. Ak. Handl. Stockholm*, 1904-1905).

From a minute examination of microtome sections of the leaves of autumn wheat, the pieces having been fixed and set in paraffin on October 6, 14 and 22, 1902, and April 22, May 29, June 5, 11 and 18, and July 4, 1903, it was again clearly shown that there was no trace of mycelium which could explain the reappearance of the disease the following year. Descriptions and drawings were given of the different phases of the evolution of the intracellular mycoplasma as well as of the course of the fungus in the intercellular spaces. The different stages of the evolution of the intercellular mycelium up to the eruption of the pustules, were also described and figured.

The author's theory did not, however, meet with approval, as can be readily understood, for the new doctrine was contrary to all the dogmas of the text-books, and to the opinions of every lecturer on the nature and propagation of cryptogamic diseases generally. The new views were regarded as heretical from the beginning, and they were to be combated by every means, legitimate or illegitimate. The author has replied in a series of publications to all the criticisms advanced up to 1911, and has now in the press a book answering the criticisms made in recent years.

#### B. — THE RUST OF THE MALVACEAE.

Amongst the best-known species of rust there is one nearly resembling the rust of cereals, the *Puccinia Malvacearum* Mont. (rust of Malvaceae). Its resemblance to the disease of cereals led the author to study this fungus and he has carried on his investigations from the beginning of the century *i. e.* for about 20 years. The results obtained during the first ten years are described in the book entitled "Der Malvenrost" (*K. Vet. Ak. Handl. Stockholm*, 1911), and he is about to publish shortly the results of the last ten years' experiments, in the work "Das Leben des Malvenrostpilzes (*Puccinia Malvacearum* Mont.) in und auf der Nahrpflanze (*K. L. A. Handl.*, Bd. 62, No. 5). These investigations have proved that this fungus also has a mycoplasma stage. The origin of this plasms, that is to say, the entrance into the host-plant, has also been satisfactorily explained by these researches.

Proof has been given of the existence of *two forms of spores* similar from the morphological point of view, but *differing biologically*. One appeared *a)* on young plants of hollyhock that had just been raised *viz.* on plants in the autumn (September-October) of their first year, and *b)* on hollyhocks that had overwintered, *viz.* plants in the autumn (August to October) of their second year. These two forms of spores only occurred in hollyhocks belonging to a diseased line. The second form was called by the author *autumn spores*. The first appears some years in spring or summer, after a free interval of 3 to 6 weeks, in May and the last

week in July, on plants that have over-wintered. These are the *summer spores* (1).

*The autumn spores can germinate in two ways.* If they find themselves immersed in water, for instance at the bottom of a drop of water, they germinate by putting forth *long filaments* which are at first slender and straight (Fig. 1  $a_1 a_2$ ), and later become curved at the tip (fig. 1  $b_2$ ). The terminal, very short articulations break up and form conidia (fig. 1  $b_2$ ).

If, on the contrary, the spores are situated *on the surface of a drop of water, or in air saturated with water vapour* they germinate by emitting short, broad promycelia curved at first (fig. 2  $a$ ) and bearing sporidia (fig. 2  $b$ ).

The *summer spores* on the other hand, *always germinate* — in water or in damp air — *in the same manner, by putting forth long filaments and conidia.*

After inoculation, the *sporidia* send through the wall of the epidermis a vesicular filament giving rise to a mycelium in the tissues in the neighbourhood of the leaf, and after 10 days new spots of rust; the *conidia* discharge their contents in the form of a mass of plasm into cells of the epidermis in order as it would appear, to take entire possession of the leaf and there lead a mycoplasmatic life. After such an inoculation, no trace of rust pustules is visible for weeks.

In addition to *diseased lines* of hollyhock, there are also *healthy lines* that remain immune throughout the whole time of their growth. A healthy line can become infected if it comes up in spring or summer next to an infected one. A diseased line can however regain its health, if the vital energy of the fungus becomes exhausted.

### C. — POTATO MILDEW.

LIT. J. ERIKSSON, *Développement primaire du Mildiou (Phytophthora infestans) au cours de la végétation de la pomme de terre* — Rev. gener. de Bot. Vols. 29 and 30. Paris, 1917-1918.

Since *Phytophthora infestans* Mont. invaded Europe, in 1845, there has been an annoying hiatus in our information respecting the life cycle of this fungus. The overwintering of the parasite and its reappearance in the potato-fields the following year are facts that have not been explained. About 1875, a great discussion arose on these subjects among scientists. Some investigators believed they had found in certain diseased portions of the plant oospores (resting-spores) of which the function was to insure the continued life of the fungus. Others on the contrary denied this explanation and maintained that the oospores which had been found did not belong to this fungus but were those of another *Peronosporacea* belonging to the genus *Pythium*, their presence in the microscopic preparations being accidental. The German Professor, ANTON DE BARY, the

(1) Twice (1914 and 1916), the author observed that the production of autumn spores continued to the spring and throughout the summer of the following year.

most eminent mycologist of the day, was requested by the British Royal Agricultural Society to investigate the matter. In a work published in 1876, DE BARY pronounced in favour of the second opinion and his view was accepted almost universally.

It was clear that no light was thrown by this verdict on the re-appearance of the disease, but that on the contrary the solution of the problem was deferred until a distant future.

At the beginning of this century the study of the development of the disease entered on a new phase. In North America, and also in England, from 1904-1915, new and extensive researches were set on foot for the purpose of filling up the gaps that still existed in our knowledge of the disease, with a view to finding a better point of departure for its control. The chief method adopted in these experiments was the growing of pure cultures of the fungus from one year to the next on artificial media. In spite of every effort however the question of the over-wintering of the fungus still remained inexplicable.

In 1915, the author himself made this disease the object of the most careful researches. For the subject of his investigations he chose the spots of the primary disease (fig. 3), appearing in Sweden on the leaves of potatoes in the open field from the middle of July to the beginning of September, three or four months after the tubers had been planted. In 1905 and 1911, very small pieces of the rust spots and of the green tissue surrounding them as well of still healthy leaves, were fixed, embedded, cut and stained according to the ordinary cytological methods. The microscopic analysis of these preparations afforded very instructive results.

The first important discovery was of well-developed oospores (fig. 4b) in the withered or half-withered parts of the spots. These oospores were globular, 20 to 38  $\mu$  in diameter, and surrounded by a thick smooth membrane. They occurred either singly, or in groups of 2 or 3 in the remains of the spongy parenchyma of the leaf. Their formation is preceded by the fusion of a male organ (antheridium), and a female organ (oogonium) (fig. 4 a). In sections containing these spores their germination could also be observed. These oospores germinate successively. They must not be regarded as resting spores, for they are on the contrary true summer-spores.

In germinating, the spore, which is either undivided or differentiated into several portions, puts forth through the neighbouring stoma, one or more slender processes (fig. 4 c), which will form the aerial mycelium and have the method of branching characteristic of *Phytophthora*.

In order to learn the true manner in which the fungus overwinters, it was necessary to discover the origin of the primary mycelial filaments, and for this purpose to examine all the zones of the leaf spot. This investigation gave positive results. In certain cells of the peripheral zone of the spot, a characteristic structure of the protoplasmic mass differing from the normal structure of the plasma was found. By the help of a high power of magnification, this plasma was seen to contain numerous minute black dots dispersed amongst the chlorophyll granules. In other cells of the

various zones of the spot, and in the dark-green region surrounding it, all the successive metamorphoses of the plasmic body could be followed, from the disintegration of the chlorophyll granules and the appearance of the nucleoli, to the passage of the plasma through the cell membrane into the intercellular spaces of the tissue, there to form the primary mycelial filaments. Some of the branches of this mycelium form antheridia and others oogonia.

In the author's opinion, there is no doubt that two different organisms are present in this plasmatic mass (one forming part of the plasma of the host and the other that of the fungus), in a condition of intimate and latent symbiosis — the mycoplasma of the author.

By means of the researches just mentioned, the life-cycles of this fungus has been followed to its close.

It only remains to be discovered how the plasma enters into the mother-plant and lives there and whether a development more or less similar to that just described, but independent of it, takes place in the seed tubers during spring and summer. This is not improbable, seeing that the tuber is the organ by which the vitality, not only of the potato-plant, but also of the fungus parasitic upon it, is carried on from one year to the next.

#### D. — SPINACH MILDEW.

Lit J. ERIKSSON, *Zur Entwicklungsgeschichte des Spinatschimmels* (*Peronospora Spinaciae* [Grew] Laub) Ark f Bot Vol 15, Nr 5 Stockholm, 1918 — Compare also: Rev gener de Bot. Vol 32. Paris, 1920

The disease of the spinach (*Spinacia oleracea*) caused by *Peronospora Spinaciae* (Grew) Laub, has been known for over one hundred years. The spots of this malady appear some weeks after sowing and attain a fair size; they are irregularly distributed on the adult leaves. Their colour varies from white to yellow, and their lower surface is covered with a kind of bluish-grey felt. The spots spread rapidly, covering all the lower surface and killing the leaf.

The overwintering of this fungus is a much-discussed question, and many efforts at solution have been made without any satisfactory result. The authors' own observations, made during the course of many years upon the mode of appearance of the disease in different years, caused him to suspect that perhaps in this case also some plasmic symbiosis existed between the fungus and its host-plant.

During the summer of 1911, the author had the opportunity of making researches in this connection. At that time spinach was being grown at Experimentalfältet, Stockholm, on two small beds in the garden which were only 30 metres apart. Between these beds there were no trees or shrubs.

The first spots of mildew appeared on the plants of one of the beds on June 18, but the plants in the second were then apparently quite free from the disease. The author at once suspected that the plants belonged to two

different lines, the one diseased and the other healthy. On the same day pieces of leaves taken from the leaves of both beds, were fixed and embedded in paraffin.

The author's suspicions as to the health of the two kinds of spinach were found to be correct. After some weeks, all the plants of one bed were nearly dead, whereas the plants in the other remained free from disease until the seed ripened. Ripe seeds were collected from the healthy bed and sown the following spring in several different places. All the plants remained immune throughout the growth period. This admits of an easy explanation. The fact that the seeds of the two 1911 crops had been bought from different seed-merchants in Stockholm, would make it probable that they had different origins.

The microscopic investigation of preparations made from the two crops was very instructive.

In the first place it should be observed that there was not the slightest trace of mycelium to be discovered, either in the plants of the healthy line or in the apparently immune leaves taken from the diseased plants.

On examining the cell contents of the two lines however an essential difference was seen. *The cells of the healthy line presented a normal appearance (fig. 5 a. b.), their protoplasm being relatively clear and transparent. In the cells of the diseased line, on the contrary, the protoplasm was less clear and less transparent (fig. 5 c).*

By means of different staining methods and the use of the highest-power lenses, it was possible to distinguish in the cell content a *fluid colloidal substance in which were embedded small bodies in the form of granules or little rods (fig. 5 d),* resembling the Plastosomes, Mitochondriae, Microsomes, etc., of the zoologists. The chlorophyll granules of the diseased line differed also in their structure from those of the healthy plants, being less compact.

In the author's opinion, there is no doubt that the fluid colloidal substance with the granular and filamentous bodies it contains, is the *morphological system* of the stage of the disease to which he has given the name of *mycoplasma*. He was able to demonstrate the elemental structure of this stage of development for the first time by means of microphotography (2500).

I

The first sign of the disturbance of equilibrium between the substance of the fungus and that of the host-cell, is the more or less complete disintegration of the chlorophyll corpuscles, which is succeeded by the nucleoli stage. From this time the fungus may be regarded as the victor in the duel between it and the cell. Symbiosis has now given place to *antibiosis*. This might also be termed the *mycoblastema* phase (fig. 6 a), that is to say, the independent plasmic stage of the fungus. The latter, which has hitherto led an intracellular existence, is now ready to escape from its captivity and enter upon its own life as a parasitic filamentous fungus invading the intercellular spaces.

Occasionally, quite young fungus-processes are also to be seen in the preparations. Two such formations, one belonging to either cell are visible in fig. 6 b. These processes take the shape of short wide *plasmic tubes*. Since the processes of several cells fuse on meeting, it may be concluded that *these tubes are not surrounded* by a definite membrane but by a *thin film of plasm*. In figure 6 c, the processes of two neighbouring cells are seen fusing in this way, growth continuing afterwards in the same manner as in the case of a single tube.

Once it has penetrated into the intercellular space, the fungus tube gradually develops to its full extent, and *assumes the appearance of a thick mycelial filament*. As in *Phytophthora infestans*, antheridia and oogonia are formed. A fusion of the contents of the male and female elements takes place resulting in the formation of oospores. The latter germinate directly, the aerial mycelium passes through the opening of the stoma. This marks the close of the vegetative period of the fungus.

#### E. — IS THE MYCOPLASMIC CONDITION A FAIRLY COMMON FORM OF EXISTENCE AMONG PARASITIC FUNGI?

In the preceding observations, the author has given as concise an account as possible of his careful studies of the following diseases; Cereal rust (*Puccinia graminis*, etc.), Hollyhock rust (*Puccinia Malvacearum*), Potato mildew (*Phytophthora infestans*), and Spinach mildew (*Peronospora Spinaciae*). These studies have led him to suppose that there exist in these fungi a method of growth of a plasmic nature within the host-plant, *i. e.* a symbiosis between the plasm of the parasite, and that of the host-plant; to this symbiosis he gave the name of Mycoplasm.

It is natural to ask whether this mycoplasmic mode of existence is peculiar to the diseases mentioned above, or if it is of fairly common occurrence in the plant world. A decisive answer to this question would necessitate new and profound studies of many diseases which are not yet sufficiently well-known.

Basing his belief on the observations he has himself made for many years, the author is disposed to suspect the existence of a more or less protracted mycoplasmic condition of existence in the following fungi: *Puccinia Chrysanthemi*, *P. Ribis*, *P. suaveolens*, *P. Tragopogonis*, *Uromyces Betae*, *U. Alchemillae*, *Cronartium ribicola*, *Phragmidium Potentillae*, *Phr. subcorticium*, *Coleosporium Campanulae*, *C. Compositarum*, *Chrysomyxa Abietis*, *Melampsora salicina*, *Peronospora Ficariae*, *Sphaerotheca mors-uvae*, *Sph. pannosa*, *Microsphaera Euonymi*, *Rhizoctonia violacea*, *Plasmodiophora Brassicae*, *Colletotrichum Lindemuthianum* and also in Tobacco Mosaic, etc.

#### F. — THE MYCOPLASM THEORY AND ITS PRACTICAL BEARING.

If the parasite is so intimately associated with the host-plant, as the Mycoplasm theory would seem to indicate, might it not be possible to use the latter as the basis for the effective control of these diseases? Could

not the vital energy of the fungus element of the mycoplasma be destroyed, or at least diminished, without affecting that of the host-plant? This is one of the questions which any investigator must put to himself, if he desires to combat the plant diseases which are such a constant source of havoc.

The author hastens to add that in view of our present knowledge on the subject there is every hope that such results are attainable. In support of this theory he brings forward certain observations made on Hollyhock rust (*Puccinia Malvacearum*), the results of cultural experiments made in 1912 and 1913, in which an attempt was made to hinder, by the addition of a fungicide to the water when watering, the growth of the fungus element of the mycoplasma that was dormant within the hollyhock.

The experiments were carried out in zinc cylinders, of which 10 were used in 1912 and 8 in 1913. These cylinders were 3 m. deep and 0.62 m. in diameter; they were buried in the soil of the experiment garden.

A. — 1912 Experiments — On 3 May, 40 plants of hollyhock were dug up, and planted 4 in each cylinder. The plants belonged to a much infested line (rose de Chatel). The seeds had been sown in the summer of 1911. The young plants remained healthy until about August 15, but from the middle of September were badly attacked by rust. They were left in the open throughout the winter being merely covered with a layer of leaves and branches.

During the first 20 days the plants were given pure water as required. On May 23 the watering of the cylinders with a mixture of 1 % solution of copper sulphate began. The proportion of toxic salt was successively increased and in the case of certain cylinders reaches 10 parts per hundred.

On June 26, i. e. after 16 days, the first rust pustules made their appearance, although few in number, in eight cylinders. From this date all the leaves of the 40 plants were carefully examined and the extent of the disease in each case expressed as follows: 0 = absence of pustules, 1 = 10 pustules at most, 2 = up to 25 pustules, 3 = up to 100 pustules and 4 = over 100 pustules. At the same time, all the leaves were marked with spots of oil paint, so as to be recognised in subsequent examinations.

On comparing the plants in the cylinders during the course of the summer and autumn, a distinct difference was noted between those watered with water and fungicide solution respectively. On the first the amount of rust rose slowly at the beginning  $\frac{26}{6} - \frac{15}{7}$ , then rapidly increased

$\frac{15}{7} - \frac{22}{7}$ , reaching the third or fourth degree of the disease on a large number of leaves. In the cylinders treated with the toxic solution on the contrary, the degree of rust intensity decreased, first rapidly and later more slowly. No new pustules appeared and the old dead sori became surrounded with black circles (fig. 7 b) showing that the mycelial tissue round them was dead.



B. — *Experiment of 1913.* — On 2 May, 32 plants of the same line of hollyhock were replanted in 8 cylinders, 4 plants being put into each cylinder. The hollyhocks remained immune until May 24, on which day a very small number of sori were discovered on the leaves of three plants. Watering with a fungicide solution began on June 4. Two cylinders were watered with pure water, two with 1 per cent toxic solution, two with a 1 per cent toxic solution at first and subsequently with a 2 per cent, 4 per cent, and finally 5 per cent solution.

The results of the experiments are given in the following table :

*Immunisation Experiments carried out in 1913 at Experimentalfältet (Stockholm).*

Day	SERIES I: Pure water, 2 cylinders, 8 plants							SERIES II: Sulphate of copper (1 %) 2 cylinders, 8 plants						
	Number of leaves attacked by rust in degree					Dead leaves	Leaves total	Number of leaves attacked by rust in degree					Dead leaves	Leaves total
	0	1	2	3	4			0	1	2	3	4		
3.6	61	1	1	—	—	—	63	55	8	—	—	—	—	63
9 -	45	15	2	1	—	—	63	46	13	2	2	—	—	63
18 -	30	8	14	8	1	2	63	38	17	4	2	—	2	63
27 -	21	6	8	21	2	5	63	37	15	4	2	—	5	—
4.7	21	5	3	21	6	7	63	43	7	—	—	—	13	63
25 -	12	16	8	24	12	12	105	44	9	—	—	—	30	83

Day	SERIES III: Sulphate of copper (1.3 %) 2 cylinders, 8 plants							SERIES IV: Sulphate of copper (1.5 %) 2 cylinders, 8 plants						
	Number of leaves attacked by rust in degree					Dead leaves	Leaves total	Number of leaves attacked by rust in degree					Dead leaves	Leaves total
	0	1	2	3	4			0	1	2	3	4		
3.6	59	3	—	—	—	—	62	63	3	—	—	—	—	66
9 -	48	13	1	—	—	—	62	45	18	2	2	—	—	67
18 -	47	10	2	—	—	3	62	49	12	3	1	—	3	68
27 -	45	12	1	—	—	7	65	45	9	2	1	—	12	69
4.7	54	4	—	—	—	7	65	48	5	—	—	—	16	69
25 -	53	26	—	—	—	21	100	52	26	3	—	—	35	116

Four days later, on July 29, a very considerable change was noticed. The plants in all the cylinders were seen to be attacked by rust in the highest degree and remained in that condition until the end of the experiment.

In his long memoir the author proposes to give a detailed account of the results obtained during his last ten years' researches on the rust of the Malvaceae, so he is here only concerned with this remarkable difference in the appearance of the fungus.

The results described above clearly prove that it is possible, by the introduction of a fungicide solution, into the host-plant, to destroy or at all

*events to lessen the vitality of a fungus for a certain period of its life without in any way injuring the host-plant itself.*

A toxic solution can greatly reduce, at least for a certain time, the destructive energy of the parasitic fungus. This fact provides us with new and *efficative* weapons for combating plant diseases. It is true that so far the good effect of the substance used showed itself only during a certain period in the life of the fungus (June-July), and that this period was followed by another during which this favourable action was absent, so that the final result was not as satisfactory as might have been desired. All the same, however, *the discovery* must be regarded *as a great step forward*, and it must especially be noted, that the period in the life of the fungus when the efficacy of the fungicide was manifested, was the transmissible mycoplasmic stage of the parasite. The author sees in these results the prospect of successfully adopting a new kind of method in combating the diseases of cultivated plants. It is, however, certain that the theory of immunisation is not yet sufficiently advanced to be turned to practical account.

There still remains much to be done before such a treatment can be applied. In the case of a possible internal treatment, it would be necessary to experiment with different fungicides against various kinds of disease, and perhaps also to try therapeutic methods with serum, as adopted by doctors in the case of the diseases of man and the lower animals. In addition, it would be necessary, in given cases, to try external treatments with fungicide powders or solutions.

Naturally in such experiments there could be no question of watering entire fields, but only of treating a small number of plants of a certain kind raised in experiment gardens or green-houses, with the object of thus obtaining healthy seed.

For the carrying out of such experiments which are of paramount importance in order to increase the world's crops, the already-existing organisations — the Botanic Gardens of Universities and Agricultural Experiment Stations — are not sufficient, if it is desired to obtain, within reasonable time, results that can be turned to practical account. Certainly **it will be necessary to found one or more special International Institutes of phytopathological research** liberally provided with all the necessary equipment (laboratories, experiment fields etc.), where the most competent investigators of the various countries can carry on their researches. Such an Institute of Phytopathological Research could first be installed in Paris and annexed to the already existing Station of Plant Pathology.

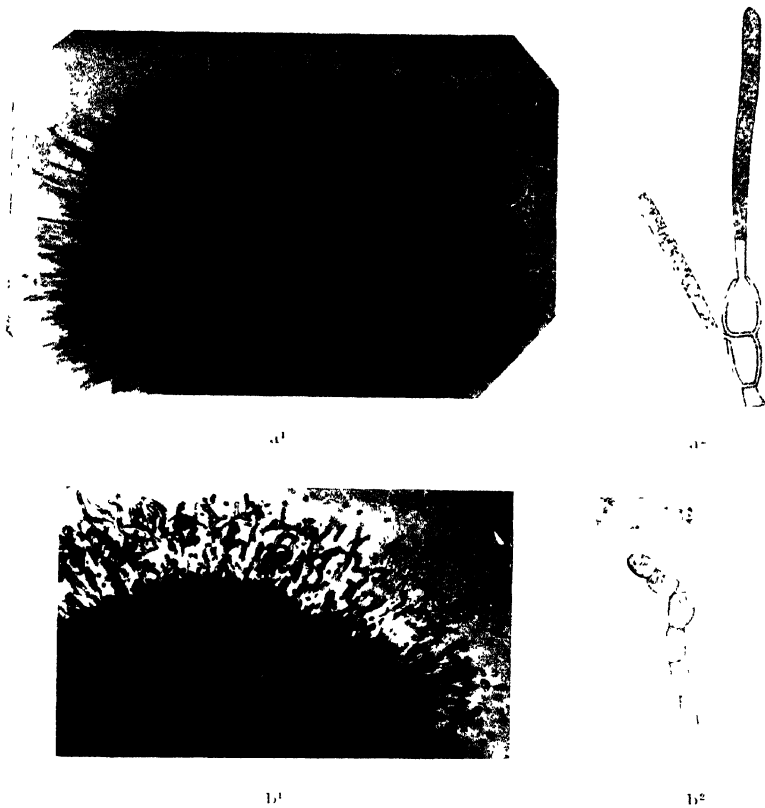


Fig. 1. *S. grisea* spores with the aid of long filament — (a) — (after 1 hour); (a') — (after 2 hours); (a'') — (after 3 hours); curved at the end (b'') — and differentiated in the form of conidia (b').

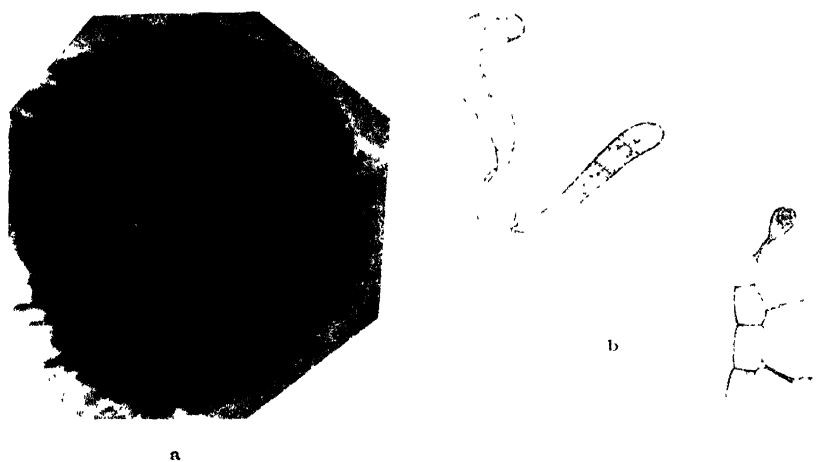


Fig. 2. Germinating spores with the aid of short and long promycelia (a) producing sporidia (b).



FIG. 3. - *Phytophthora infestans*. First appearance of the normal disease in the fields at the end of the summer (hence, a negative action; afterwards white spots)



a

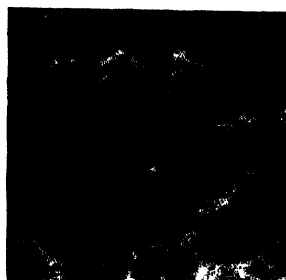
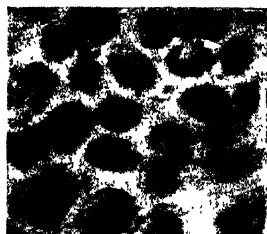


b



c

FIG. 4. - *Phytophthora infestans*. Foliage tissue broken up: a) entheridium and oogonium ( $\frac{1000}{1}$ ), b) two mature oospores ( $\frac{300}{1}$ ), c) oospore having germinated ( $\frac{850}{1}$ ). (Microphotographs)



b

d

Fig. 5. *Peronospora Spinaciae*. Healthy *spinacia*. a) group of foliage cells ( $\begin{smallmatrix} 1000 \\ 1 \end{smallmatrix}$ ); b) group of chlorophyll cells ( $\begin{smallmatrix} 500 \\ 1 \end{smallmatrix}$ ); c) group of foliage cells ( $\begin{smallmatrix} 1000 \\ 1 \end{smallmatrix}$ ); d) group of the content of typical cell ( $\begin{smallmatrix} 500 \\ 1 \end{smallmatrix}$ ). (Microphotograph)



a

b

c

Fig. 6. *Peronospora Spinaciae*. a) State of mycoblastemose of the fungus ( $\begin{smallmatrix} 2500 \\ 1 \end{smallmatrix}$ ); b) state of plasmatic disorganisation of the fungus ( $\begin{smallmatrix} 2500 \\ 1 \end{smallmatrix}$ ); c) the plasmatic channels of two adjoining cells are fused in a single tube ( $\begin{smallmatrix} 2500 \\ 1 \end{smallmatrix}$ ). (Microphotograph)

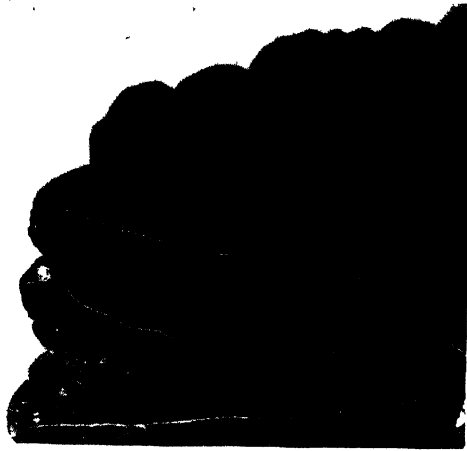


FIG. 7.

## SECOND PART

### A B S T R A C T S

## AGRICULTURAL INTELLIGENCE

### GENERAL INFORMATION.

- 225 - **The New Bureau of Agricultural Economics and the Scientific Work of the Department of Agriculture of the United States.** — WALLACE, H. C. (U. S. Secretary of Agriculture), in *Report of the Secretary of Agriculture*, 1921, pp. 16-27. Washington, 1921.

AGRICULTURAL  
DEVELOPMENT

The Secretary of Agriculture of the United States being convinced of the necessity for devoting as much attention to the economics of Agriculture as to the encouragement of production, if agricultural crises are to be avoided, decided after consulting expert opinion, to unite into a single Bureau (that of Agricultural Economics) the already-existing Bureaux of Crop Estimates, and of Markets and Farm Management and Economics and to concentrate in one bureau all the activities of the Department which are devoted to the economic aspect of Agriculture. The purpose of this new bureau is to enquire into every economic condition and tendency which affects either production or price, for the one depends upon the other.

The first questions to be studied will be farm management, types of farming, cost factors and market grades and practices, so far as they bear on the management of the farm, the cost of production and distribution being also considered at each stage. Investigations will also be made in land economics with a view to encouraging the most economical methods of working; land resources and the best means of utilising them; land settlement and colonisation; the marketing of farm products with a view to an improved organisation of distribution; market conditions; standardisation and grading of products; collection of statistics of production and distribution; crop and live-stock production in the United States and other countries; prices of farm manufactured products; historical and geographical studies in production and distribution with a view to interpreting the trend of agricultural prices and production; the development or decline of markets and the general geography of the world's agriculture; methods of finance; insurance of buildings, live-stock, and stocks in storage; taxation and its relation to production and distribution; the financing of

rural public utilities and other group enterprises ; agricultural conditions in countries which compete with the United States ; the characteristics and changes in rural home life and its relation to agriculture ; the trend of agriculture and population ; in short, everything that may assist the farmer along the path of scientific production. Such studies and investigation will be just as helpful to consumers as producers, for the ultimate purpose is to obtain an abundant supply of the products of the soil at prices which will support agriculture and be just to the consumer.

Much of this work is already in progress in the Department of Agriculture of the United States in accordance with the provisions of the organic law by which it was created in 1860. This department was charged with the duty of acquiring and diffusing "information on subjects connected with agriculture in the most general and comprehensive sense of that word."

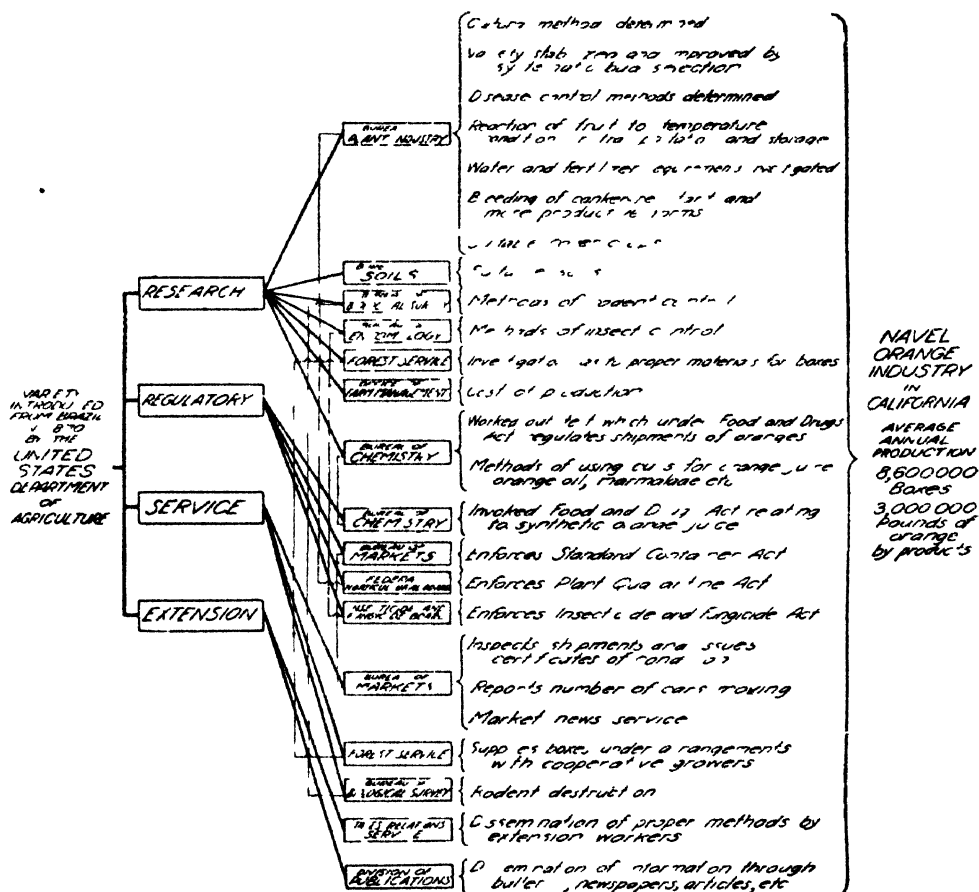
The production of food has long been considered as an obligation, but it is no less an obligation to bring it to the consumer with the least possible waste and expense. Marketing is as truly a part of production as crop-growing, for crops are of no value unless they can reach those who require them. The collection, storage and distribution of farm products require the same economic and technical knowledge as that needed by farmers. The acquisition and dissemination of knowledge of what to produce and how best to put it on the market so as to guarantee abundance of food at all times and at moderate prices cannot be gained from a study of marketing alone, but involve research in agronomic, biological, physical, statistical and economic science by men trained in their respective lines and having a working knowledge of agricultural processes and conditions. In fact the knowledge of what to produce involves study of the varieties, qualities and quantities demanded by the market. In the case of fruit for instance, it involves the selection or the breeding of suitable varieties by the horticulturist, a study of life processes by the plant physiologist, and the study of liability to attack by bacteria and fungi on the part of the plant pathologist. Practically all agricultural products are more or less perishable, and it is only by the co-operation of horticulturists, plant physiologists, phytopathologists, chemists, refrigeration experts and statisticians that it has been possible to give to American agriculture that distinctive character which makes it feasible to produce perishable commodities on one side of the continent and market them without serious deterioration on the other.

The accompanying chart showing the development of the Navel orange industry serves as a very good illustration.

In the marketing of grain, investigations are necessary on the milling and baking qualities of wheat and other grains, and for the purpose of determining the test weight per bushel, gluten content, colour, texture, general appearance, different forms of damage and adulteration to which grain is liable in handling. All this is necessary, not merely in order that the grain may be properly graded, but also that the most suitable kinds of grain may be bred, introduced and grown. This work has the profoundest



# DEVELOPMENT OF NAVAL ORANGE INDUSTRY



effect on farm operations. The cereal breeders in the Department, especially those engaged in the breeding of wheat, work with those engaged in the studies of grain markets and standards. The closest collaboration is also necessary between the specialists of the Department, who are familiar with varietal adaptation and the rapid changes taking place in the varieties grown by farmers, and those persons who have to do with the market, and particularly those concerned in formulating and administering grain standards. The rapid increase in the growth of red durum wheat made it necessary to introduce new standards for this class of wheat. Diseases play an important part in determining the market grade and value of cereals. The presence of smut for instance materially reduces the price of wheat and is always taken into account in grading. The shrivelling of wheat caused by rust and the presence of mouldy and rotten ears and spoiled kernels in maize due to rots and other fungoid diseases greatly affects their market value. Therefore the work of research specialists either in developing methods of controlling the disease, or in producing resistant varieties, is of importance not only to farmers, but to the grain trade and to consumers. It is necessary that the biological research workers should be in close touch with those who are studying grain-marketing and grain standards, so that the latter may be advised of outbreaks of new diseases or of the occurrence of already-known maladies. Crop rotation and farm management affect the purity of the products, and are therefore important factors in determining the grade of grain sold by the farmers. Practically every phase of research has its bearing upon marketing and benefits both producer and consumer.

Naturally, the basic work of the Department is in the field of research and it is upon the results of this work that its other activities are built. Of the 2500 different lines of investigation carried on in 1920, some of the most important may be mentioned : a new process for manufacturing phosphoric acid (without the immense waste in mining phosphates) and thus reducing the cost of fertilisers ; a method for separating the colloidal particles of the soil which is expected to throw light on such problems as cultivation of soils, the amount of water required by certain soils, their capacity for retaining plant foods and their reaction to lime ; the development of better methods for fixing atmospheric nitrogen for use as a fertiliser ; a soil survey that has completed the mapping of soils over an area of 1 063 588 square miles, including 31 915 square miles in Alaska and 300 square miles in Porto Rico, the work covering about 950 districts and 50 survey areas ; investigation of the rots of maize root, stalk and ear to determine the causes and methods of preventing these obscure and wide-spread diseases ; investigations of the effect of light and especially of the length of the day on plant development, furnishing explanations of phenomena in plant growth not previously understood but essential to accurate experimentation in the breeding of plants for economic purposes ; methods of accurate measurement of the productivity and other important characteristics of perennial plants, such as fruit trees, through bud selection which make it possible to replace undesirable trees by better types of the same va-

riety ; experiments for the purpose of improving the milking quality of cattle ; completion of the establishment of a breed of general utility fowls laying white eggs ; breeding experiments leading to the fixing of a type of American utility horse ; studies to ascertain the cost of producing various farm crops, and the cost of marketing ; studies to throw light on the whole marketing problem as a basis for the more efficient organisation of the various marketing processes, whether the work is carried out by individuals or by groups of farmers ; research to determine the composition of agricultural products in order to develop more uses for waste and surplus crops ; basic researches on the composition of foods and drugs in order to establish standards to prevent adulteration and to improve methods of manufacture ; research to develop methods of chemical analysis for the use of chemists in Agricultural Colleges, Experiment Stations and those connected with Federal, State, and Municipal food and drug departments ; the development of measures for the control of crop pests that have recently gained a foothold in the country ; researches to determine the characteristics of materials intended for highway construction ; researches to determine improved methods of highway design to meet modern traffic conditions ; studies of hydraulic problems, including the factors influencing the passage of water in drainage canals.

It is impossible to estimate the value of this research work, but the money spent on it is capital invested by the Nation in building up a permanent agriculture. Its dividends come from increase in yields, decrease in cost of production and marketing and better utilisation of crops, all having for their purpose the maintenance and increase of our food supply.

G. A. B.

226 - **The Present Position of Research in Agriculture in Great Britain and Suggestions as to the best Methods of Application to Practical Farming.** — I. HALL, Sir A. D. (Chief Scientific Adviser and Director General of Intelligence Department, Ministry of Agriculture), *The Present Position of Research in Agriculture*, in *Journal of the Royal Society of Arts*, Vol. LXIX No. 3567, pp. 300-312 London, April 1921 — II. VOELCKER, J. A., *How Best to Utilise the Results of Agricultural Research in Practical Farming*, in *Journal of the Farmer's Club*, Pt. 6, pp. 109-129. London, Nov. 1921.

AGRICULTURAL  
RESEARCH

I. — The organisation of research as applied to agriculture in Great Britain may be dated from 1909 when the Development Commission was established (1) and a scheme was formulated, dividing the field of research up by subjects and charging various Institutes with the fundamental research work for one particular branch, as a rule in conjunction with a University. This method was adopted in order to ensure concentration of effort, and to avoid overlapping and duplication and to give each Institute an opportunity to work out a continuous scheme of research and deal with the subject as a whole. Now that research is removed from immediate State control (apart from expenditure), the advantage of the association of the Research Institutes with the Universities has become evident, ensuring as it does informal co-operation with other workers in the

(1) See *R. May* 1913, No. 452. (Ed.)

field of pure science. Moreover the University which is teaching agriculture, comes into closer contact with the farmers in its district and much more so than a Government Department.

The Institutes that have already been established under the Scheme may be set out as follows :—

- 1) Soil and Nutrition of Plants, at Rothamsted Experiment Station, Harpenden (1).
- 2) Plant Pathology, at Rothamsted
- 3) Animal Nutrition, at Cambridge and Aberdeen Universities
- 4) Plant Breeding, at Cambridge and Aberystwyth (2).
- 5) Fruit Growing, at Long Ashton (Bristol) and East Malling (Kent)
- 6) Dairying, at Reading.
- 7) Plant Physiology, at the Imperial College of Science, London
- 8) Agricultural Economics, at Oxford.

The Plant Pathology Institute at Rothamsted represents a combination of previous Institutes dealing separately with entomology, mycology and helminthology. The Staff is kept in daily contact with the workers upon soil and plant problems

The two Institutes for Animal Nutrition are attacking different aspects of the same general problem. At Cambridge the Balfour Professor of Genetics receives a grant to carry out investigations into the laws of inheritance in animals which may prove of service in developing the science of breeding. The opinion is expressed that a wider scheme should be put forward dealing with Animal Husbandry as a whole including problems of a physiological character, etc

The Plant Breeding Institute at Cambridge deals chiefly with cereals and other farm crops, and the Aberystwyth Station (2) with grasses, clovers, oats and fodder crops appropriate to the wetter climate of the west. In order to relieve the Institutes thus engaged in the work of commercial distribution, the National Institute of Agricultural Botany has been set up at Cambridge to receive new varieties of farm crops from the Plant Breeding Institutes and to grow and test on a large scale before putting on the market in commercial forms.

The two Institutes dealing with fruit problems work in very close harmony and represent different conditions of soil and climate as regards fruit growing in the eastern and western counties respectively. A small Experiment Station at Waltham Cross (under the general supervision of Rothamsted) deals with the problems of the fruit and vegetable grower who works under glass.

The workers on Plant Physiology at the Imperial College of Science are associated with the Fruit Growing Stations for the purposes of obtaining material and for the conduct of the field experiments required.

Two subjects have up to the present not received sufficient attention.

(1) See « Book of Rothamsted Experiments » by Sir A. D. HALL (Second Edit. Revised by E. J. RUSSELL), Murray, Albemarle St., London, 1919

(2) See *R. Ang.* 1921, No. 808 (*E. d.*).

Firstly, diseases of animals :— It is considered desirable to set up an Institute for research into the comparative pathology of human beings and animals, with a view to obtaining results economically important both for the livestock industry and public health. Up till now the only work undertaken has been at the Research Laboratory at Addlestone, where certain questions specifically bearing upon the administrative work of the Ministry of Agriculture are investigated. A grant has also been made to the Royal Veterinary College for research work and recently to the London School of Tropical Medicine for investigations into the internal parasites of domestic animals.

Secondly research connected with agricultural machinery is of high importance. The future development of large scale agriculture depends greatly upon the application of machinery to farm work, and existing machinery probably requires certain radical modifications in view of the greater pace at which implements can now move because of the general introduction of mechanical power upon the land. Certain proposals in this direction are under consideration. The co-operation of the chief implement manufacturing firms must necessarily be assured.

*Advisory Officers.* — An essential feature of the Research scheme has been the further provision of a number of advisory officers attached to the various agricultural colleges, and relieved of their main teaching functions in order that they may give advice to farmers and horticulturists in their area, and conduct local investigations for their benefit. Eventually it is hoped to provide each college with 3 officers, as a rule a mycologist, an entomologist and a chemist, with modifications according to the special needs of the locality. Regular conferences are held between these officers, more especially the pathologists, directors of the related Institutes and the technical officers of the Ministry's Staff. In this way a systematic service is obtained to deal with plant pathology all over the country, which gives a general idea of prevailing conditions and furthurs the possibility of a combined attack upon any disease of widespread distribution. At the same time these officers serve as intermediaries between the Research Institutes and the farming public, on the one hand disseminating the results of practical importance, and on the other, advising the Institutes on problems that have been revealed locally, which may prove to be beyond the resources of the individual adviser.

**MOST IMPORTANT PRACTICAL RESULTS WHICH HAVE ACCRUED FROM THE WORK OF THE VARIOUS INSTITUTES.** — I. *Soils and manures.* — 1) Rich cake-fed dung must be got early on to the land, if great losses of nitrogen are to be avoided.

2) The most essential feature in the treatment of the ordinary dung heap lies in protection from washing by rain.

3) If crude sewage (1) be passed through a filter bed made up of straw, the straw will pick the soluble nitrogen compounds out of the

(1) The Sewage Sludge as Manure. See R. Aug. 1915, No. 793; R. Sept. 1920, No. 843. (Ed.)

sewage in order to start the humification process. Some 60 % of the nitrogen is removed from the effluent which becomes comparatively harmless, and the straw itself is converted into manure.

These conclusions were drawn after a series of valuable investigations carried out on the bacterial processes which bring about the making of farmyard manure, based on the discovery of a widely distributed cellulose fermenting organism, a *Spirochaete*, (1) by HUTCHINSON.

Further trials are in progress to enable market gardeners, etc. to obtain effective farmyard manure without depending on animals, a necessary step due to the present diminution of town stable manure.

II. — *Plant breeding*. — Of special interest is the fact that wheats have been produced which under East Anglian condition have added 10 % to the farm yield (BIFFEN'S experiments at Cambridge). Some of these wheats combine the "strength" of Canadian wheats with the English cropping powers.

Experiments are in progress to solve the problem of lodging in cereals.

III. — *Animal nutrition*. — A set of real growth curves is being obtained showing for each stage of the animal's development the relation between the food consumed, the live and dead weight, the useful meat and fat and the offal. (Investigations at Cambridge).

Investigations (at Aberdeen) into the vitamine factor in the nutrition of farm stock are leading to valuable results.

IV. — *Fruit growing*. — The confusion which has arisen from a mixture of stocks upon which fruit trees are grafted, leading to lack of uniformity of habit, etc. is being gradually righted, and it is now possible to work with true stocks for apple trees.

Research is also in progress on fruit preservation.

V. — *Plant diseases*. — Immunity rather than curative methods is the chief aim; the success so far obtained is evident in the case of the wart disease of potatoes (*Synchytrium solani*), immune varieties which will grow untouched in the most heavily infected soils having been discovered. (2)

VI. — *Economic investigations*. — The Research Institute at Oxford has started to work out methods for ascertaining the cost of agricultural production.

Special emphasis is laid on the fact that the State is getting value for its expenditure and that the majority of really fruitful ideas and conceptions that have recently become current in agricultural science have sprung from English laboratories. Attention is drawn to the fact that Rothamsted is at present undoubtedly the most completely and efficiently equipped agricultural laboratory in the world, and while the other Institutes up till now are on the material side inferior to Rothamsted, they all display an activity of mind and a fertility of invention and method that can be matched in no other country.

(1) See *R.* July 1919, No. 820, and No. 236 of this Review (*Ed.*).

(2) See *R.* Feb. 1914, No. 182, *R.* May 1918, No. 519; *R.* April 1920, No. 420 (*Ed.*)

**EXPENDITURE.** — The total funds set aside in the current estimates for research service amounts to £105 000 as compared with £38 250 for 1913-14. It is interesting to observe the expenditure in the form of grants to Colleges and Institutions during the academic year ending September 20, 1920 :

<i>a</i> ) Scientific Research and Experiment :	£
1) Capital expenditure (Statement <i>A</i> ) . . . . .	28 588
2) Maintenance Expenditure (Statement <i>B</i> ) . . . . .	52 470
<i>b</i> ) Extension of Advisory and Local Investigation Work (Statement <i>C</i> )	13 798
<i>c</i> ) Special investigations and researches not included above* (Statement <i>D</i> ) . . . . .	2 028
Experiments with Agricultural Machinery ** . . . . .	4 000
Miscellaneous Enquiries, experiments, etc. . . . .	1 500
Research scholarships **. . . . .	1 900
	101 284

\* Grants made to individuals in furtherance of approved schemes of investigation, intended for the benefit of teachers, etc in Agricultural Colleges, Universities, etc. other than Research Institutes.

\*\* Financial year ended March 31, 1921, estimated.

Details are given of the amount paid out under headings *a*, and *b c*.

It may be noted that the greater part of the expenditure goes upon the salaries of research workers and the State undertakes to provide the salaries with certain increments for a defined number of officers. This step has been taken in order to ensure that the general conditions are suitable for the highly trained University graduates who are best fitted for research work. The system of scholarships permits promising students to engage in research under the guidance of an Institute with a view to possible promotion.

**II. — UTILISATION OF RESULTS OF RESEARCH IN PRACTICAL FARMING.** — Dr. VOELCKER testifies to the value of the Universities, Colleges and Experiment Stations as sources of information, but devotes special attention to the methods so far adopted and others that might be employed for bringing the farmer into direct contact with these scientific teachings, always bearing in mind the somewhat conservative attitude of the farmer class with regard to science.

*a*) *Value of Agricultural Publications.* — These have accomplished a good deal, but seeing that the ordinary agriculturist is not a great reader and that many of the agricultural monographs bearing on practical problems are not readily understood by the farmer, it is considered advisable to introduce science into the ordinary school curriculum as soon as possible and thus pave the way to a clearer understanding.

*b*) *Value of Experimental Work.* — The importance of each station keeping in close touch with all other stations at home and abroad is emphasised (1) but the chief aim should be to give a clear interpretation of the

(1) " On the Continent, through the United States and Canada, also at centres in India and elsewhere, there are experimental and research stations each issuing regularly its report of work and in turn, keeping in touch with Rothamsted and other Stations. The work of

scientific discoveries and their practical bearing in order to allow the farm student to have a thorough grasp of the situation. Where practical experiments have been carried out on experimental farms run in conjunction with the various Colleges, and these have been made readily accessible to the farmer, distinct progress has been made.

c) *Agricultural Colleges and Farm Institutes*. — Apart from the Research stations mentioned elsewhere, opportunities for complete training in agricultural science are given to students and young farmers and in many cases provision is made for carrying on experiments on individual farms in the surrounding area. Among the best-known colleges are Armstrong College (Newcastle-on-Tyne), Leeds University, Harper Adams College (Salop), Midland Dairy and Agricultural College (Loughborough), the University Colleges of Aberystwyth, Bangor and Reading, and Wye College (Kent).

In addition to the more scientific instruction, there is a group of lower grade Institutes and Farm schools attended by persons who can only give part time to learning and are otherwise engaged in actual farm work. Here demonstration farms take the place of experimental farms, and a general teacher of science replaces specialised teachers of particular branches. The best known at present are the East Anglian Institute at Chelmsford (Essex), Marton (Rugby), Newton Rigg (Penrith), Sparsholt (Winchester) and Usk (Monmouth).

d) *Agricultural Organisers*. — The value of the services of the itinerant lecturer and advisor is fully acknowledged (see Pt. 1).

From the results obtained up to the present it appears that before long a practical knowledge of the application of scientific discovery will be much more readily acquired to the ultimate benefit of agricultural progress.

M. L. V.

227 - **Report of the "Imperial Economic Botanist" Pusa, India 1920-1921 with Reference to Wheat, Tobacco, Fibre Plants, Oil Seeds, Grain, and Indigo, including Physiological Investigations.** - HOWARD, A., and HOWARD, G. I. C., in *Scientific Reports of the Agricultural Research Institute, Pusa, 1920-1921*, pp. 8-20, p. 11, bibliography of 7 works, Calcutta, 1921.

WHEAT. — The demand for botanically pure seed of Pusa wheats for trial in various parts of India including the Indian States, for starting new centres of seed distribution and for restocking old ones has been continuous. Special demands were made for Pusa 12 and Pusa 4 and a record has been kept of the progress made in the systematic replacement of the country wheats by these two varieties and in the first area selected, viz. the Central Circle of the United Provinces, it was decided to aim at the complete replacement of the country wheats of the alluvium, by Pusa 12 and in the district of the Bundelkhand canals by Pusa 4 and to base the various distribution schemes on the central seed farm at Kalian-

these stations is regularly summarised in the "International Review of the Science and Practice of Agriculture" published by the International Institute of Agriculture, Rome. (*Author's note*)



pur (1). The aims and objects of the work and the progress made are expressed in concrete form, and a description is also given of the various unofficial methods of seed distribution which have been tried by the Agricultural Department.

The chief aim of the work done taken as a whole was to establish a definite co-operative movement for the distribution of the improved seed and the consequent introduction of varieties superior to the local types hitherto cultivated. To attain this end, side by side with the various seed distributing agencies, the Agricultural Department has conducted a continuous series of village demonstrations.

The importance of strength of straw in wheat cultivation is well brought out in some wheat trials carried out by W. N. HARVEY at Gorakhpur. Plots of Pusa 4 and the local wheat, 0.24 acres in area were sown in triplicate and the wheat was irrigated once. In spite of wind and rain in January which laid the local variety, Pusa 4 stood well till harvest and gave a yield of 29.50 maunds of seed per acre (1 maund = 82.28 lb.). The sparse foliage of Pusa 4 combined with the natural strength of its straw and its short growing period combine to make it a suitable variety for trials in intensive cultivation. A yield of as much as 40.75 maunds per acre has already been obtained on the large scale at Mangalghar (Bihar) under estate conditions.

One of the limiting factors in the growth of wheat in India is soil-temperature. It has however been reported by S. K. BASU, Deputy Director in Orissa, that varieties which mature with great rapidity, and require a short growth period can be matured in tracts where the cold season is too short for the ordinary crop. He recently raised a crop of Pusa 4 of over 18 maunds per acre on the rice areas in which the paddy crops had been destroyed by high floods the preceding July. The wheat was sown the first week in November and harvested early in March. These trials are being extended in new tracts.

With reference to water saving in wheat cultivation, the results obtained in North-West India are notified in *Bulletin 118 of the Agricultural Institute of Pusa* (reproduced from *Quetta Bulletin* No. 4).

*Trials of the New Pusa Wheats.* — One of the objects of this work is to obtain a bearded wheat with strong straw which will yield as well as Pusa 12 under cultivator's conditions. Pusa 54, giving an average yield per acre of 32 maunds, 34 seers and other types not yet tested at Kalianpur appear promising for this purpose, (when compared) with the average yield of Pusa 12, viz. 33 maunds, 8 seers.

Some of the Pusa wheats have evidently been found useful in breeding elsewhere. Prof. SCHRIBAUX of the Institut National Agronomique, Paris reported in June 1921 that by crossing the rust resistant Pusa 4 with Bordeaux, the hybrids obtained were clearly resistant to rust.

TOBACCO. — There has been an increased demand for type 28 from

(1) The present position of the work has been summed up in the *Agricultural Research Institute, Pusa, Bulletin* No. 122, by BURT, B. C., HOWARD, I. A., and HOWARD, G. L. C. (Ed)

the Indian Leaf Tobacco Development Company and successful trials have been conducted recently at Guntur in the Kistna delta in accordance with the local demand for seed. In these experiments about 97 % of the plants lived when transplanted and gave a tobacco of very good colour, useful for cigarette manufacture. The Company is also undertaking trials of this variety in British East Africa, Kenya and Zanzibar. After providing for 50 000 acres this year, sufficient seed for 60 000 acres has been carried over for 1922 but the advance indents have already reached this figure.

**FIBRE PLANTS.** — A successful trial of the improved variety of "patwa" (*Hibiscus cannabinus*) (1) known as type 3 is reported by the South African Jute Company, Barberton, South Africa; the plants withstood drought, gave stems 10-14 ft. high, and a yield of fibre 35 maunds per acre on land freshly broken. (These trials are being continued on a larger scale). Type 3 has as a result been given a trial at Pusa and elsewhere, but only a small supply of pure seed has been so far maintained. It is expected shortly to be able to prevent natural crossing more easily and thus enable the extension of the crop areas.

Breeding work on roselle (*H. Sabdariffa* L.) discontinued in 1919 and 1920, has since been resumed.

**OIL SEEDS.** — Considerable progress has been made in the isolation and study of the unit species which make up the Indian linseed crop of commerce. Results are awaiting publication when the types have been repeated for detailed verification of the classification. The testing of some of the unit species has been started and is yielding promising results.

An exhaustive examination has been made in Great Britain of the commercial possibilities of safflower (*Carthamus* spp.) oil. The work has been carried out by S. S. REMINGTON at Aynsome, Grange-over-Sands, Lancashire who reports on its distinct economic value for colour, paint and varnish industries, for soap and linoleum manufacture, as well as for edible purposes and its possibilities for refining and bleaching. Further investigations are in progress on the proteins of the safflower seed and it is considered advisable to test the changes taking place in the oil under ozonisation, further weathering tests, etc.

**GRAIN.** — Some progress has been made in the testing of a number of promising types of grain. Large scale trials have been in hand with Pusa 17 and Pusa 18 which gave 21 and 22 maunds of grain per acre respectively. These trials were, however, interfered with by premature hot winds when the plants were in flower.

**INDIGO.** — Apart from the several publications issued recently on this subject (2) it is interesting to note that the authors' views on the impracticability of the improvement of Java indigo by chemical selection have been confirmed by an independent examination of the question

(1) For notes on *H. cannabinus*, see *R* April 1918, No. 420; *R* Feb. 1919, Nos. 146 and 1140. (*Ld*)

(2) See *R* Jan 1922, Nos. 50 and 101. (*Ld*)

by W. R. G. ATKINS (Indigo Botanist 1920). (See *Science Progress*, July 1921).

One interesting observation on the growth of Java indigo was made during the year which is worthy of record. In 1919 indigo was sown in an uncemented lysimeter with free drainage and splendid crops were obtained and no trace of wilt was observed (1). The stumps were left in the soil and two cuts were obtained the following monsoon (1920) after which a change took place in the physical condition of the soil, drainage became impossible and the plants died. In October 1920, the soil was removed from the lysimeter and at once replaced. Java indigo seed was sown the same day and up to the time of writing two fine healthy cuts have been obtained and the stumps are shooting again. This result appears to be directly opposed to the theory of phosphatic depletion, which has been advocated to account for the well-known difficulties in the growth of indigo in the Bihar soils. Here is a case where Java indigo has been grown for leaf for 3 years in succession in a comparatively small volume of Pusa soil without any falling off in vigour.

PHYSIOLOGICAL INVESTIGATIONS. — Attention is at present directed towards the determination of the factors involved in the observed deleterious action of grass on fruit trees. A mass of results on this question has been obtained during the year which will shortly be published. Another subject under examination is the influence on growth of the various factors involved in poor soil aeration.

A result likely to prove of practical value has recently emerged from these investigations. During the rains of 1920 (a year of short rainfall), and in 1921 up to the end of August, it has been possible to preserve the lucerne crop and to carry it on successfully for two seasons by growing it on flat beds 3 ft. wide with irrigation furrows 1 ft. wide between the beds.

This method is now being applied to the growth for seed of crops like sanai (or Sunn hemp *Crotolaria juncea*), safflower and Java indigo and it is considered likely to prove useful in the growth of jute seed in Bengal where similar monsoon difficulties exist.

A number of observations have accumulated also on the physiological aspects of disease resistance and on the conditions of the root system and of the soil which appear to precede infection by insects and fungi.

In 1921-1922, investigations on the lines indicated in the annual reports and in the publications of the Section, will be continued on the following crops — cereals, tobacco, fibre plants, pulses, oil seeds, fodder crops and fruit, and also on soil aeration and root development. M. L. Y.

228 — **The New Service of Agricultural Ecology in Italy.** — *Nuovi Annali del Ministero per l'Agricoltura*, Year I, Part 2, pp 395-398. Rome, December 1921.

By virtue of Law No. 500 of April 7, 1921, a new Service of Agricultural (Ecological) Meteorology was instituted. Its duties consist in the systematic study of the physical environment in which agriculture is

(1) See R. Oct. 1921, No. 1057. (Ed.)

practised with a view to determining by a well-defined method the principles governing the adaptation of crops to the climate of the different physiographical regions. These studies will at first be confined to such meteorological phenomena as have the most easily measurable effects, but later, with the co-operation of the Geological Bureau, the investigations will be extended to the agro-geological and topographical factors, in order to obtain a complete knowledge of the physical conditions under which farm-crops grow.

The new Service is sub-ordinate to the " *Direzione Generale d'Agricoltura* ", Division IV) (Agricultural Instruction and Experiment), and consists of a Central Bureau of Agricultural Ecology and of several Ecological Stations.

**CENTRAL BUREAU.** — In addition to its directing and centralising work and the usual technical and administrative duties, the Central Bureau is also required to :

a) provide instruments tested by the Central Bureau of Meteorology and Geodynamics, in order that the meteorological observations may be perfectly comparable ;

b) control the varieties from the botanical standpoint, so that the biological data may be comparable as far as possible ;

c) make a comparative study of the thermic and hygroscopic properties of the soil in connection with this line of research.

d) collect the information and data supplied by the station ; control and elaborate such information and data.

As the new Institute develops the Central Bureau will gradually assume the functions of a Central Experiment Station of Agricultural Ecology.

With the kind permission of Prof. Romualdo PIROTTA, the Bureau has carried out some experimental researches in the Botanic Gardens of the University of Rome ; similar work is also being carried on at the Practical School of Agriculture of Rome

**STATIONS OF AGRICULTURAL ECOLOGY (I).** — Of these there are three categories :

a) First-class Stations where parallel observations are made on the course of meteorological phenomena in the air and at various depths in the soil, and on the development of the plants and varieties according to the instructions received from the Central Bureau.

b) Second class Stations where meteorological observations in the air, and observations of plant growth are made.

c) Supplementary Stations. Here independent Studies are carried out without the aid of special instruments on the growth of plants and crop yield in connection with weather conditions.

At the present time these Stations are in direct communication with

(1) In order to form a network of these Stations the State Agricultural Institutes (Agricultural Colleges, Agricultural Stations, etc.) are being utilized and special Stations are in course of construction. (Ed.)

the Central Bureau to which all the data are sent. Gradually as the Directors of the First Class Stations acquire the necessary practice and experience for dealing with this branch of work, the stations will be granted a certain amount of autonomy and will themselves become Regional Centres having subordinate to them the Second Class Stations and the Supplementary Stations within their sphere of operations.

*Registration of Observations.* — For this, two kinds of form are used.

1) A form on which are entered parallel observations on plant-growth and meteorological conditions, determined objectively without instruments. On this form are noted the details (beginning and end), connected with the different growth stages ; germination, tillering, heading, etc. In the case of each, the conditions affecting the plant positively or negatively are also entered.

2) Tables drawn up in the usual manner on which are registered the observations made with the help of instruments.

*Utilisation of the Data.* — By working up the data according to the method proposed by the Bureau, an accurate knowledge is acquired of the connection between a plant and its environment. In the first place the plant is analysed in order to determine, in each given case, the genetic factors or groups of factors governing the behaviour or reaction of the organism under different conditions of temperature, hygroscopicity, etc. noting the deficiency or excess. In the second place a careful examination is made of the environment as a function of the development and yield of the plant, in order to determine amid the complex interplay of the environmental factors, the value or the groups of values, exercising a dominant influence upon the yield, and to bring into prominence the characters of susceptibility and resistance to disease that are governed by the various genetic factors.

A sure basis is thus obtained for the direction of the operations undertaken to lessen the discrepancy between the plant and the conditions under which it grows.

Thus in the case of wheat, definite information is obtained on the following points :

1) Which among all the varieties cultivated in or suitable for introduction into a region is the most suitable for any given locality.

2) The best dates for sowing, so that the times when the plant is most susceptible may coincide with the most favourable periods.

3) The best cultural operations and the most suitable time for carrying them out, in order to counteract the negative action of unfavourable meteorological conditions.

4) These data are also used to direct the breeder who is anxious to unite in the same individual, and in definite proportions so as to obtain the maximum yield, the two characters, specific productivity and resistance to the most dangerous and injurious meteorological conditions.

In short a decrease in risk (as regards weather changes) is thus effected and hence an increased yield without useless outlay, which means a real increase in the value of the capital.

Such systematic and continuous work has to be pursued for a long time

before yielding averages of any value. This branch of work is common to all the Stations, but the Central Bureau recognises the importance of combining general research work with the study of local problems and has directed the different Stations to investigate the difficulties that arise in their immediate neighbourhood.

Since 1919, under the auspices of the Società degli Agricoltori italiani (now the Istituto Nazionale d'Agricoltura), the Director of the Service has been engaged in drawing up a biological census of wheat (1) and has sent the following list of questions to the Directors of all the Agricultural Institutes of Italy.

1) What meteorological conditions are injurious to wheat? State in the case of each at what time in the growth period of the plant it occurs, and the number of times in a decade.

2) What are the fungoid diseases and other causes of reduced yield of which the appearance and development are closely connected with the state of the weather?

3) What varieties of wheat are cultivated? State in the case of each:

- a) The area occupied in % of the total area under wheat;
- b) If this area tends to increase or diminish, give the reasons;
- c) How does the wheat behave under unfavourable meteorological conditions.

Useful replies to these questions were given in 194 cases.

The material thus collected will not only furnish data for a monograph on climatic conditions of wheat-growing in Italy (which is soon to be published) but, after the necessary tests have been made and the results verified, will show, in the case of each district, the most important meteorological problem which must be investigated and explained without delay.

The Ecological Station have therefore a twofold object:

- 1) *general* (the systematic study of the environment).
- 2) *special* (the study of local problems).

\* \* \*

The Bureau will publish synthetically all the results obtained, and will send all information and suggestions of a useful and practical character to the following Institutions:

1) Agricultural Experiment Stations' and "Cattedre ambulanti d'Agricoltura" (in the case of all questions connected with the choice of varieties, the optimum date for sowing and for other operations).

(1) By the Decree under date of February 20, 1920, this census is extended to all the wheat-growing countries and the data thus obtained will be used in the preparation of a general monograph on the Climatic conditions of Wheat-Growing. (Ed.)

2) Institutes of Genetics and Phytotechnical Stations. These will receive :

a) An account of the researches undertaken for the purposes of determining accurately the physiological region where a new variety can be introduced with success ;

b) All ecological data that will guide students of heredity in their researches as far as the conditions of the physical environment are concerned).

3) Bureau of Irrigation (information regarding the dates when irrigation is necessary).

4) Bureau of Statistics (scientific explanation of statistical data).

5) Institute of Plant Pathology (the Bureau will furnish the data required for organising the control of those insect and fungoid diseases whose appearance and development are clearly correlated with weather conditions).

G. A.

## CROPS AND CULTIVATION

229 - **Experimental Researches on the Critical Period of Wheat, as Regards Rainfall in Italy.** — AZZI, G., in *Nuovi Annali del Ministero per l'Agricoltura*, Year 1, No. 2, pp 290-307 Rome, December 1921

AGRICULTURA  
METEOROLOGY

The results of a series of experimental researches on the critical period of wheat as regards the heading stage, and on the behaviour of the 4 varieties employed.

These experiments were carried out during the agricultural year 1920-1921, at the Botanic Garden of the University of Rome.

**MATERIALS AND METHOD.** — Varieties of wheat examined: *Apulia* (Rieti × Spelta), *Cervaro*, *Carlotta Strampelli* (Rieti × Massy), seed supplied by M. STRAMPELLI, and *Spella*, seed supplied by MM. ANDRIEUX-VILMORIN.

The fact that one variety, unlike the others, does not suffer from injuries due to drought may be due to various causes :

1) The heading is early or late which displaces the critical period, so that the drought occurs at a time when the plant is less susceptible to its effects.

2) The roots penetrate deeply, thus allowing the plant to draw water from the supplies that have accumulated in the lower strata of the soil when rain is absent, and the surface is insufficiently damp.

3) The plant's structure is such as to enable it to economise water and thus attain the same results (straw and grain production), with less water consumption. This is true drought resistance, and is the object of this work.

The plants were grown in pots filled with the same kind of soil, and were kept under cover in a movable shed during the critical period.

There were for each variety, 20 pots divided into 4 lots or series : A, B, C, and D.

All the pots without distinction were watered copiously from Dec-

ember 29 to April 12 (1st sub-period), and from the 7th day after heading until maturity (2nd sub-period), and therefore did not suffer from any lack of moisture.

In the interval (2nd sub-period) from April 12th to the 6th day after heading (when it is to be supposed that the effect of moisture would be most noticeable), the series *A*, *B*, *C* and *D* were subjected to different treatments.

Series *A* was watered 3 times on May 5, being given 45 mm. each time, and twice on May 8 receiving 30 mm. each time.

Series *B* was given 30 mm. of water twice on May 5.

Series *C* was given one watering of 15 mm. on May 5.

Series *D* was not watered at all.

Pot experiments have many drawbacks, but in the present case they have the advantage of limiting the study to a great extent, and confining it to the question of real drought resistance, by suppressing the effect of root-penetration and of the date of heading.

RESULTS. — The amount of water placed at the disposal of the plant affects the date of heading in so far that the latter is retarded in proportion as the conditions of the environment become worse.

The following phenological data were obtained :

Varieties

Cervaro . . . . .	May 9	May 10	May 15	May 18
Apulia . . . . .	" 13	" 15	" 17	" 18
Spelta . . . . .	" 18	" 25	" 28	June 1
Carlotta Strampelli . . . . .	" 20	" 20	" 21	May 28
General average . . . . .	May 15	May 17	May 20	May 24

This progressive retardation even if it were also to occur under normal conditions in the case of farm-crops, could not fail to have a deleterious effect, as it would induce late maturity in the plants; ripening took place in fact at the same time in all the series, the order being as follows: Apulia, Cervaro, Spelta, Carlotta Strampelli. From the beginning of maturation, the difference between the watered and unwatered plants manifested itself very clearly. The latter developed badly and remained very low; the ears scarcely emerged from the foliar sheath; heading was incomplete and even entirely absent in some individuals.

In the Apulia variety the tendency to shrivel up, manifested by the leaf-blades was noticeable, some becoming almost spike-like in shape (in the series *C* and *D*), which reduced the respiration surface.

All the plants gathered were biometrically examined with regard to the following characters: length of culm; weight of culm; length of ear; weight of ear; number of grains per ear; weight of grains per ear; weight of each grain; weight of rachis. All these characters are posi-



tively associated with the straw length, and should vary according to the same rules.

The author has limited himself to giving the data that are absolutely necessary for the purpose of demonstration. In the Tables the numbers marked with an asterisk represent values lower than those calculated, probably due to the difficulties experienced in maintaining absolute uniformity of conditions in all the pots.

In estimating the data and the harvest, the twofold object of the work must never be lost sight of:

1) The experimental proof of the existence of a critical period for wheat as regards rainfall at the heading stage;

2) The special behaviour of the 4 varieties examined.

As regards the grain yield, its direct relation with the rainfall during the critical period was clearly shown, increasing the watering also increased the weight of the grain borne by each ear. On taking the average of *A*, *B*, and *C* and comparing it with *D* the difference between the watered and unwatered plants is still more striking (See Table I).

The 4 varieties may be divided into a 2 lots according to their special behaviour. Cervaro and Apulia *most drought-resistant*, and Spelta and Carlotta *least drought resistant*.

1) *Spelta and Carlotta*. -- The yield of the unwatered pots was very scanty; if the amount of water is increased, the yield also increases rapidly and the difference between the two lots, the unwatered and the watered, which can be expressed by the quotient obtained by dividing the average of *A*, *B*, *C* by *D*, is very high: Spelta = 2.6; Carlotta = 3.0.

2) *Cervaro and Apulia*. -- The return, even from the unwatered pots, is relatively high — 3 to 4 times more than in the case of Carlotta and Spelta. With the progressive increase of the amount of water placed at the disposal of the plant, the increase in the weight of the grain is less rapid than in the preceding case, and the difference between the average of *A*, *B*, *C* and that of *D* is somewhat slight. In fact, the quotient is reduced to 1.1 and 1.2 for Cervaro and Apulia respectively. Similar conditions are found again as regards the weight of each seed; this can be also considered as an index of the quality of the product (see Table III). In Carlotta Strampelli, there is a regular, ascending curve from *D* to *A*. Thus, *D* = 1.5 cg; *C* = 1.9 cg; *B* = 2.6 cg, *A* = 3.0 cg.

The straw yield, both from the standpoint of the weight and the length of the culms, confirms as regards the existence of the critical period, what has already been observed in the case of the grain: the weight and length of the culms increases with the increase in the amount of water given (See Table III). Cervaro gives the most regular curve: *D* = 53 cm; *C* = 61 cm.; *B* = 74 cm.; *A* = 77 cm.

In series *D*, the difference between the Cervaro-Apulia group and the Spelta-Carlotta group is very great (Cervaro = 53 cm.; Apulia = 53 cm.; Spelta = 36 cm.; Carlotta 35 cm.) and it remains the same, unlike what has been found in the case of the grain; this also applies to the 4 varieties (from 1.4 to 1.5).

The correlation between the length of the ear and the amount of water given during the critical period, is on the contrary a little less close, in spite of the positive connection between the length of the culms and the length of the ear. The correlation coefficient for Apulia is almost reduced to zero: in the series *D*, the length of the ears is almost the same as in series *A*, and is greater than in *B* and *C*. This capacity of reducing the growth of the culm, under unfavourable conditions without shortening the ear, might be interpreted, given further verification, as a character of adaptation to drought.

As regards the characters: weight of ear, number of grains per ear, etc. which are positively correlative with straw length, the same general observations hold good as those made in the case of straw length.

GENERAL CONCLUSIONS. — 1) The existence of a critical period (occurring in the interval between the 6th day before heading and the 6th day after the appearance of the ear), is entirely confirmed by these experiments. The straw length and all the correlative characters are increased (rise in value) with the increase in the amount of water placed at the disposal of the plant during the critical period.

2) The four varieties of wheat examined can be divided into two groups according to their behaviour as regards the above-mentioned phenomena:

A) Apulia and Cervaro, more resistant to drought.

B) Spelta and Carlotta, less resistant to drought in the following order: Cervaro, Apulia, Spelta, Carlotta. This order may however, be somewhat modified by the further experiments in progress: the growth of the plant and its grain yield also depend upon the specific productivity of each variety, which has not yet been accurately determined.

3) The actual productivity of a plant is the result of a compensation established between specific productivity "and resistance to the most injurious environmental factor."

The productive capacity usually decreases with the increase in vigour; hence, a plant that is very resistant to drought and unfavourable meteorological conditions, even if provided with the best environment for its development, always gives a relatively low yield.

On the other hand, a vigorously growing variety bearing large ears (high specific productivity), but not possessed of the necessary drought-resistance, when placed in dry surroundings does not develop at all, or only produces seed that cannot set. Of this Carlotta Strampelli is the typical case; this wheat is also endowed by heterosis with a high specific productivity that manifests itself with the progressive improvement in the environmental conditions. On the present occasion, the plant did not succeed even when watered 5 times, in completely filling the grains which still remained shrivelled.

Spelta is certainly possessed of a much lower productive capacity.

As for Cervaro and Apulia, there are not enough data to be able exactly to estimate their xerophily: even from observations made during its vegetative period, Apulia seems to have very distinct capacity for adapt-

ing itself to a dry climate; the greater productivity of Cervaro might therefore be attributed to a greater specific productivity which is however always below that of Carlotta, and ran no risk of being impaired by the lack of moisture to which it was subjected in the course of the experiment.

In Cervaro it would appear that specific productivity and drought resistance are united in the best proportions.

TABLE I. — *Weight of Seeds per Ear in cg.*

Varieties	Number of waterings					Difference between watered (a) and unwatered plants (s)	$\frac{a}{s}$
	0	1	2	5	$1+2+5$ 3		
Cervaro . . . .	53	47	66	73	62	9	1.1
Apulia . . . .	39	46	30	65	47	8	1.2
Spelta . . . .	13	26	37	30	34	21	8.6
Carlotta Str. .	14	33	50	46	34	29	3.0
<i>General average</i>	<b>26</b>	<b>38</b>	<b>46</b>	<b>54</b>	<b>46</b>	<b>17</b>	—

TABLE II. — *General Averages for the 4 Varieties of Wheat.*

	Number of waterings					Difference between unwatered and watered plants
	0	1	2	5	$1+2+5$ 3	
Weight of seeds per ear in cg. . . .	29	38	46	54	46	17
Average weight of each ear in cg. . .	2.17	2.50	2.47	3.10	2.70	0.53
Length of culm in cm. . . . .	44	56	60	64	61	17
Length of ear in cm. . . . .	6.6	6.6	7.2	7.9	7.0	0.4

G. A.

230 — **Evaporation and Other Soil Properties found to be Connected with Soil Constitution.** — I KEEN, B. A (Goldsmiths' Company's Soil Physicist, Rothamsted Experimental Station), The Evaporation of Soil. Influence of Soil Type and Manurial Treatment, in *The Journal of Agricultural Science*, Vol. XI, Part 1, p 132-140, figs 2 Cambridge, October 1921. — II. KEEN, B. A., and RACZKOWSKI, The Relation between the Clay Content and certain Physical Properties of a Soil, *Ibidem*, pp. 441-449, Figs. 5.

SOIL PHYSICS

In an earlier paper (1) the author had shown that the essential difference in the evaporation from sand and soil was primarily due to the colloidal portion of the clay fraction in the soil, and secondly, to the organic matter present. The experiments now described were carried out on two soils,

(1) See R. 1015, No 248. (Ed)

one of which contained about 6 % of clay, and the other 15 %. In order that the influence of manurial treatments could be studied at the same time, samples were taken of each soil from the unmanured plots, and plots given farmyard manure, and complete artificial manure, respectively. The rate at which the soils lost water over concentrated sulphuric acid and at a constant temperature, was found to depend firstly, on the amount of clay present, and secondly on the amount of organic material in the soil. The differences due to content of organic material were more obvious in the soil containing the larger amount of clay, the farmyard manure plot lost water at the slowest rate and the unmanured plot occupied an intermediate position.

In the sandy soil, the differences in evaporation due to manuring were small.

There is evidence that the moisture equivalent of these soils, measures the percentage of water at which the evaporation is first directly affected by the soil particles and that, at percentages of water in excess of the moisture equivalent, evaporation is taking place substantially from a free water surface.

II. — It is well known, that the behaviour of most soils, is largely determined by the percentage of clay they contain, for this reason the authors proposed to measure various fundamental properties of a given soil (such as pore-space, apparent and real specific gravity, volume, expansion of soil when saturated) at different depths and as affected by the clay content.

The results obtained showed that the weight of unit volume of air-dry soil, viz., its apparent specific gravity, and its real specific gravity, varied inversely with the percentage of clay in the soil, whereas the amount of water it takes up, pore space and volume expansion when saturated, varied directly with the clay percentage. The effect on the constants of the larger quantities of organic matter present in the top two layers of soil of 15 cm. and from 15 to 30 cm. was, weight for weight, approximately equal to that of the clay, except in the volume expansion results where the effect, if any, was within experimental error. It is possible that a fine silt fraction with an upper limit of diameter of 0.005 mm. may have similar effects to the clay fraction.

G A B.

**231 — The Chlorine Index as a Comparative Measure of the Nitrogen Content of Soils.**—

VEIL C, in *Comptes rendus de l'Académie des Sciences*, Vol. CLXXIV, pp 317-319, Paris, January 30, 1922.

Hypochlorite of sodium when in contact with arable soils, loses its active chlorine. It has been shown that the amount of chlorine which thus disappears is connected with the humus content and affords an index of the probable fertility of the soil (1).

The author adopted the same method in order to discover whether any correlation exists between the chlorine index thus determined and the nitrogen content. He investigated the connection between the amount

(1) *See R.* 1919, No 424. (*Ed*)

of chlorine in the soil ( $\text{cm}^3$  per  $\text{cm}^3$ ), and the nitrogen present (gm. per 100 dry weight), using for the purpose soils for which, as far as is known, no chemical fertilisers had been used. A certain number of samples came from the neighbourhood of Paris, others from Brittany, Haute-Marne and Morocco, there were 20 in all.

Generally speaking, the higher the chlorine index the greater the nitrogen content of a soil. Three classes can be clearly distinguished:

1) Very rich soils, where the nitrogen content is above 4 per 1000 and the chlorine index higher than 30.

2) Soils with a low humus content, where the nitrogen content is above 1 per 1000 and the chlorine index varies between 7 and 12.

3) A series of soils of average richness, with a nitrogen content varying between 15 and 27, and chlorine indices above 1 per 1000 and below 2 per 1000

G. A. B.

232 -- **Researches on the Presence of Arsenic and Iodine in Soils and Subterranean Water in Argentina.** - I. RICHART, F. TRELLIS. R. A. (Laboratorio Químico de Investigaciones Agropecuarias, Facultad de Agronomía y Veterinaria, Universidad Nacional de Buenos Aires), Sobre la presencia del arsénico como elemento normal en las tierras vegetales, in *Revista de la Facultad de Agronomía*, Vol. III, Part 3, pp. 281-284, 1 pl., bibliography of 9 works, Buenos Aires, December 1927. - II. IDEM, Iodo y arsénico en las aguas subterráneas, *Ibidem*, pp. 285-287, 1 fig., bibliography of 12 works.

The classical researches of GAUTIER have proved that arsenic is normally present in the animal organism. JADIN and ASTRUC have shown that this arsenic comes from vegetable foods, and as the plants consumed must obtain their supply of this substance from the soil, it is necessary to determine the arsenic content of the latter.

For this purpose the authors analysed the Argentina plant products. Arsenic was always found in the latter, but in smaller quantities than had been observed in Europe, except in the case of the seeds for instance of wheat grain harvested in regions where the soils are rich in arsenic. The authors analysed 20 different soil samples and found the arsenic content varied from 0.08 mg. to 2.25 mg. for 100 gm. of air-dried soil; it was not possible to determine the relation between the amount of arsenic and iron present, but it was found that arable soils always contained arsenic and that there was no connection between their chemical composition and their arsenic content. The latter is highest in the upper layers and decreases with the depth.

Although there is no general rule, it appears possible that some connection may exist between the amount of arsenic in the soils and in the subterranean waters beneath them, as has been observed in an arsenical district (North Santa Fé).

It should be remembered that iodine and arsenic are constantly present in the waters of the pampas, their amount depending on the chemical composition of these waters, and on the geological nature of the soil. Water containing chlorine, sulphur and sodium bicarbonate have the highest iodine and arsenic content, while those coming from granitic or calcareous soils have the lowest. The iodine may be derived from marine deposits.

but it must not be forgotten, that it is of constant occurrence in soils, atmospheric dust and freshwater algae, and also that all other plants are relatively rich in iodine, as has been shown by the researches of GAUTIER and others.

G. A. B.

233 - **Concentration of the Hydrogen Ion in the Soil and in Plants.** — I. ATKINS, W. R. G., Some Factors affecting the Hydrogen Ion Concentration of the Soil and its Relation to Plant Distribution, in *The Scientific Proceedings of the Royal Dublin Society*, Vol. XVI, n. 5, Nos. 30-34, pp. 369-423. Dublin, 1922. — II. IDEM, The Hydrogen Ion Concentration of Plant Cells. *Ibidem*, p. 414-426. — III. IDEM, Note on the Occurrence of the Finger and Toe Disease of Turnips in Relation to the Hydrogen Ion Concentration of the Soil, *Ibidem*, pp. 427-434. Bibliography.

I. — The author gives a critical review of the literature dealing with the concentration of the hydrogen ion in the soil, and the factors exerting an influence upon this concentration and its relation to plant distribution. He reaches the following general conclusions.

In the first place it is desirable, in order to determine the fundamental relations existing between the ions present in the soil solution and its hydrogen ion content, to consider separately the effects of the different salts. When water is in contact with pure calcium carbonate the theoretical maximum alkalinity is only pH 9.01 (1) which may be attained experimentally in the absence of carbon dioxide. The corresponding bi-carbonate in equilibrium with the gases of the atmosphere is pH 8.37 at 16° C becoming more alkaline at higher temperatures. Owing to the high content of carbon dioxide in the soil, the pH values of limestone soil are usually lower and they vary with the aeration.

The theoretical maximum alkalinity for magnesium carbonate is pH 10. Dolomite soils may thus attain to greater alkalinity than limestone soils. Alkalinity of over pH 10, due to sodium carbonate, may be reduced to pH 8 by the addition of calcium sulphate. The former reaction is injurious or destructive to plant cells, whilst the latter is favourable to most plants.

Soil acidity may be occasioned by the oxidation of sulphur from iron pyrites. This acidity favours the production of available phosphate and is accordingly beneficial to certain plants. Owing to production of carbonic acid by bacteria, a soil extract may decrease in alkalinity from pH 8.7 to 7.2 or less; the result in the soil appears to be to render iron salts more readily available in calcareous soil when inundated, than when uncovered. The alteration is usually more rapid in soils from the top 6 inches than at greater depths.

Continuous manuring with sulphate of ammonium or of potassium, decreases the effective soil alkalinity, even in a calcareous silt, but by a small amount only, about pH 0.2-0.4 in the cases examined.

An acid soil extract is only slightly altered by boiling; in one instance, from pH 5.4 to 5.7. Alkaline extracts tend to reach the maximum value for calcium carbonate pH 9.0. Higher values, such as pH 9.2, appear to indi-

(1) See R. February 1919, No. 159 (*Ed*)

cate the presence of magnesium in small amounts. The altered reaction is probably of importance in inhibiting the growth of certain soil organisms in heated soil.

When arranged in order of decreasing alkalinity, soils derived from different materials stand as follows: — calcareous silt, limestone, sandstone, calcareous tuff (schalstein) with slate, ordinary state, pillow-lava (spilite), felsite and granite. The values are modified in certain places, for proximity to the coast lessens acidity and a high gradient often increases it. The results relate mainly to Devonian strata and the accompanying volcanic or plutonic rocks.

The author gives figures for the hydrogen ion concentration of the habitats of over a hundred native plants. These show that the measurement is a valuable index of various soils conditions and that many plants are limited to a short range of pH values; others with a wider range occur within certain definite pH values, but some plants grow well at widely different soil reactions. A distinction must be made between acid peaty soils, acid clay soils and acid sandy soils. It is interesting to note that wild flowers grown in a garden, do best when the soil reaction is similar to that in their native habitat.

Natural waters, even from the peaty districts examined, contain no acid other than carbonic. Water in a spring may be at pH 6.4 and the stream flowing from it at pH 8.3 when in equilibrium with the atmospheric concentration of carbon dioxide. Photosynthesis may raise water containing magnesium salts to pH 9.7. The hydrogen ion concentration of natural soft waters, tends to increase during winter and to decrease in summer.

II. The author then treats of the hydrogen ion concentration within the plant and in the actual living cells, and gives a brief account of the previous work on the subject from which he draws the following conclusions.

Plant cells are rarely alkaline and pH 8 is not exceeded in them. On the acid side pH 1.4 has been observed. By a microchemical method it is possible to determine the pH values of the cells and tissues; it has been found that the xylem is more acid than the pith and medullary rays, and the midrib of a leaf is more acid than the parenchyma. Parenchymatous tissue is often in the neighbourhood of pH 6, while woody tissue is nearer pH 5, or more acid. When grown in alkaline or neutral soil, the root is usually less acid than the other parts of the plant. The author reserves the influence of soil reaction for consideration in another paper.

It has been pointed out that the pH value met with in a tissue is usually near but slightly less than the optimum for the activity of the characteristic enzyme at ordinary air temperature. This ensures that the acidity does not destroy the enzyme at such higher temperatures as may be experienced by the plant under natural conditions.

III. — It has long been known from the results obtained by VOELCKER and other workers (which were collated by HALL in 1910), that finger-and-toe disease occurs in soils poor in calcium salts. The author mentions the case of two adjacent turnip fields of similar clay soil one of which was

badly infested with finger-and-toe disease in the crop, while the other was entirely immune. It was found that the calcium content (calculated as oxide), was respectively 0.17 % and 0.40 %; the hydrogen-ion concentration of the samples was respectively pH. 6.6 and pH 6.7. In other words, the soil of the infected field was the more acid and it would be useful to determine the pH limits within which the fungus producing finger-and-toe disease (*Plasmodiophora brassica*), is able to develop. G. A. B.

234 - **Researches Made in Denmark, upon the Effect of Soil Conditions on Bacterial Life and the Chemical Transportations taking place in the Soil: the Capacity for Decomposing Mannite.** — CHRISTENSEN H. R. (145 Beretning fra Statens Forsøgsvirksomhed i Plantekultur), in *Tidsskrift for Planteavl*, Vol. XXVIII, Part 1, pp. 1-58, figs. 5 Copenhagen, 1922

The author has previously had occasion to study the power of fixing atmospheric nitrogen, possessed by different soils. The soils were mixed for this purpose with mannite and put for some weeks into a thermostat to incubate (1). The observations made seemed to show that there are considerable differences in the mannite decomposing-power of various soils, and as it also appeared probable that these differences were connected with the agricultural properties of the soils, it was thought well to investigate the whole question of how far a capacity for decomposing mannite depended upon the nature of the soil. A satisfactory method of research was first selected, whence it was found that the moisture content of a soil determines the rapidity as well as the course of the mannite decomposition process, and that in order to attain the approximate maximum decomposition, the humidity must be about 75 % of the water capacity of the soil. Since a large number of ordinary soils had been used the author tried to discover the capacity of mannite decomposition as shown by the rapidity of this process, and following his predecessors, he investigated both inoculated and uninoculated cultures in order to determine the differences due both to the chemical composition and microbiological nature of the soil. He also determined the reaction of the soil samples, and the phosphoric acid soluble in hydrochloric acid and carbonated water respectively, and finally the amount of lime and magnesia soluble in 10 % ammonium chloride.

The author first found that the rate of the mannite decomposition varied within very wide limits; in certain cases, the process was completed in 5 days, in others it was not complete even at the end of 30 days. After due consideration it would appear that there is a definite relation between the reaction of the soil (especially within limits very close to the point where it becomes neutral) and its power of decomposing mannite, for soils that are shown to be well-supplied with lime, and are thus favourable to the development of *Azotobacter*, generally have a greater capacity for decomposing mannite than those having a deficiency of lime and lacking *Azotobacter*. This difference is still more noticeable, if distinctly acid or alkaline soils are compared. There are however notable exceptions to this rule, these seem on the one hand to show that soils with sufficient

(1) See R. 1917, No. 996. (Ed.)



lime possess, more often than those deficient in it, the qualities determining the rapidity of the mannite decomposition process, while on the other hand, no connection has been found between the amount of phosphoric acid soluble in hydrochloric acid present in a soil, and its capacity for decomposing mannite. On the other hand, soils needing no lime, and with much phosphoric acid soluble in water containing carbon dioxide, have also a great power of decomposing mannite; in fact if the concentration amounts to 1.2 mg. of phosphoric acid per litre, mannite decomposes very rapidly in such inoculated soils, with but rare exceptions. Further, the decomposition of mannite takes place as a rule much more quickly in inoculated, than in uninoculated soils; usually however the differences are slight, so that we are justified in saying that the degree in which mannite is decomposed depends chiefly upon the chemical composition of the soil.

In order the better to understand the effects of the chemical factors, the author treated the soils with lime and various phosphate salts. The results proved that the rapidity of the mannite decomposition depended upon the presence of slightly basic lime compounds and readily soluble phosphoric acid.

These facts are of great importance, but further research is necessary with regard to the extent to which the speed of the mannite decomposition in soils needing no lime, may be an index of the amount of phosphate compounds present that are very soluble and capable of speedy assimilation by plants; such an index being afforded by the *Azotobacter* test in the case of soils that are deficient in lime.

A first step taken in this direction by the study of a series of soils proved, by a series of field experiments lasting for several years, to be lacking in phosphoric acid. The results were very satisfactory, for they showed that these soils, which agricultural experience had proved to be decidedly in want of phosphoric acid, had a very low capacity for decomposing mannite, whereas soils well provided with phosphoric acid broke up mannite quickly. Further, when normal amounts of superphosphates are applied for a certain number of years to soils requiring phosphoric acid, the mannite decomposing capacity of these soils is greatly increased. The experiments so far made are, however, not sufficiently extensive to warrant any conclusions as to the practical value of this method in determining the phosphoric acid requirements of the soil.

In the latter part of the article, the author deals with the connection between the reaction and basic character of the soil, and its content in phosphoric acid soluble in hydrochloric acid and in water containing carbon dioxide, and of lime and magnesia soluble in ammonium chloride. These correlations show very clearly that an alkaline reaction and the presence in the soil of certain basic compounds, like those of lime, are necessary conditions of a somewhat high content of phosphoric acid soluble in water containing carbon dioxide, and finally, that the form under which phosphoric acid is found in soils is determined to a large extent by their reaction

G. A. B.

235 - The Spring Awakening of Arable Land and the Choice of Agricultural Machines. — RINGELMANN, M., in *Journal d'Agriculture pratique*, Vol. 35, No. 7, pp. 132-135 Paris, February 19, 1921

The author considers LUMIÈRE's paper (1) on the "Spring Awakening of Arable Land" from the point of view of the agricultural machines and operations required. All that is needed is some simple apparatus mounted on a stubble-plough, a pulveriser, or a cultivator with flexible teeth.

According to LUMIÈRE, the roots of plants and also the dead leaves and aerial portions of annual plants secrete toxic products that are inhibitory agents preventing the seeds germinating, and should therefore be removed as quickly as possible by fermentation, oxidation or dilution.

This hypothesis explains the beneficial effects of various cultural operations: dry-farming, ploughing fallow land for a year, the repeated use of a cultivation with flexible teeth instead of ploughing (JEAN method) (2), etc.

It also shows that it is necessary in preparing the autumn seed-bed, only to loosen the soil to a slight depth without turning it but at the same time to dig and subsoil it as deeply as possible, in order to facilitate the free passage of the rain, which first washes the superficial layers of the soil, promoting the germination of the seeds they contain and then, passing on to the greater depths, removes the toxic products from the lower strata at the time the roots of the new plants will reach them. The toxic products would thus be present in relatively large amounts in the lower layers of soil.

The furrows then act as small elementary drains that hasten the removal of soluble substances by the rain water. For this reason it is advisable to use implements with coulters that are relatively narrow for most of their length, but wider at the point, so as to make narrow channels; the section of the latter should be smallest when the soil is most compact and heavy, as this minimises the compression and slipping of the earth.

Ploughing should therefore not be carried to a depth exceeding 10 to 15 cm. After the harvest has been carried, it may be assumed that the toxic products are most abundant in stratum *l* (fig. 1); after ploughing, this stratum, which is for the time unsuited to germination, is arranged in parallel inclined planes *l'*; these after the passage of the roller or harrow take up the position *l''*, so that the seeds finding themselves from the beginning under good germinating conditions are those occupying the triangles *g*; those situated elsewhere will germinate later when the rain has washed the superficial layers. Instead of ploughing to the depth *yo*, it would therefore be better not to go deeper than *yn*, the exact figure is to be found by experiment. It is however, also advisable to loosen the soil *in situ* to the depth *nm*, in order to allow the rainwater to drain away easily and free the strata *nm* from toxic products, before the roots of the crop have penetrated so far.

The best agricultural machines to use are stubble ploughs working to a depth of 7-10 cm., or pulverisers penetrating to 5-8 cm., provided each

1) See *R.* Jan. 1921, No. 11, (14)

2) See *R.* April 1916, No. 386 (14)

mould-board *A* (fig. 2) is fitted with digging claws or teeth *f* which penetrate as deeply as possible, 20-25 cm. for instance, before the furrow is cut by the plough.

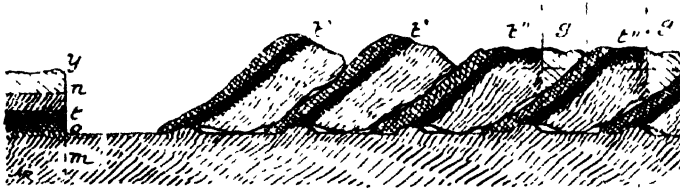


Fig. 1. — Transverse section of ploughing.

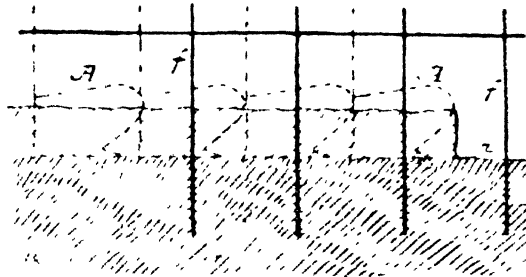


Fig. 2 — Principle of stubble-plough with digging teeth.

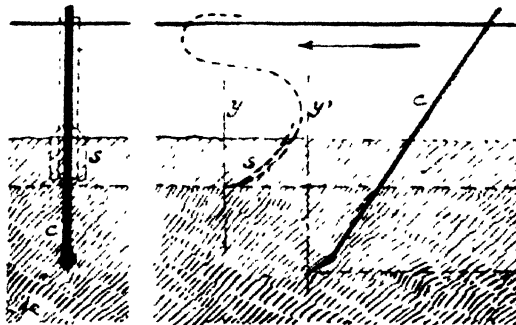


Fig. 3. — Principle of cultivator digging coulters.

Such digging teeth, which resemble coulters, may be introduced between the disks of the pulveriser.

The same principle can also be applied to cultivators. In this case, it would be necessary to affix the digging coulters shown diagrammatically

at *c* (fig. 3), behind each share (*s*) of the cultivator (or every second share), the latter working a breadth of 12.5 cm. (teeth per metre of width of the carriage), and to a slight depth. The distance between the verticals *y* and *y'* by passing the extremities of *s* and *c*, which will give most work with the minimum traction, must be determined by experiment.

After the passage of the above-mentioned machines it is well to use a clod-breaking roller to consolidate the surface. The roller, which must be of the required breadth, can be attached to the back of the machine. The loosened superficial layers must settle down, for in LUMIÈRE'S experiments its consolidation is proved by the water used for washing the soil.

The seed being sown at depths varying from 3 to 6 or 7 mm., it is only necessary to loosen the soil to a depth of 10 cm. in order that the first rains can rapidly wash the surface.

What has been said refers solely to the preparation for the autumn sowing, for in the spring the rains and snows of winter insure the soil being washed to a depth below where the seeds are lying. Further, the ground is well ploughed in the autumn, and superficially ploughed several times in spring, which agrees well with LUMIÈRE'S experiments.

G. B.

MANURES  
AND  
MANURING

236 - The Conversion of Straw into Farmyard Manure. - HUTCHINSON, H. B. and RICHARDS, E. H., in *The Journal of the Ministry of Agriculture*, Vol. XXVIII, No. 3, pp. 398-411, figs. 2, London, August 1921.

As a result of the recent extension of the area under cereal crops, it was thought that there might remain a surplus of straw which could not be employed for the usual purposes of stockfeeding and litter. It was therefore determined to investigate the possibility of converting it directly into manure, in order to supply the market-gardeners who found it increasingly difficult to obtain adequate supplies of stable-manure.

As a result of experiments carried out at the Rothamsted Experimental Station, a method was devised by which straw can be converted into a substance having many of the properties of stable manure.

In a considerable number of the preliminary experiments, to secure the usual disintegration and colour changes in fermenting straw, the most promising results were obtained when the straw was subjected to the action of a culture of aerobic, cellulose-decomposing organisms (e. g. *Spirochaeta cytophaga*). Further enquiry showed, however, that this effect was not due simply to the presence of an organism capable of breaking down cellulose, but rather to the indirect effect of the mineral substances contained in the culture fluid. From this stage onwards, the question of food supply, as distinct from the addition of any particular species of organism, received special attention and the results obtained were of both theoretical and practical importance.

The great importance of air supply, was shown by an experiment in which 4 lots of straw were fermented under aerobic and anaerobic conditions for 3 months at 37° C. The results were as follows:

	Loss of dry matter	
	Straw without Nitrogen	Straw with Nitrogen
Without air supply . . . . .	16.3 %	17.1 %
With air supply . . . . .	40.1	58.9

As a rule special measures to maintain a favourable temperature are not necessary. Moist straw rapidly undergoes a preliminary fermentation during which the temperature may rise to over 65° C. It is, however, in the subsequent stages that the effect of treatment has most effect in maintaining the temperature. Experience has shown that a supply of nitrogen, by increasing the energy of fermentation, leads to an increase of 15-20° C in favour of straw which has received a sufficient supply of nitrogen, as compared with untreated straw.

Repeated experiments have proved that the most rapid break-down of straw occurs when some source of nitrogen in an available or indirectly available form was supplied, but only when the reaction of the solution was neutral or slightly alkaline. The addition of urine, urea, ammonium carbonate or peptone, with certain concentrations, immediately sets in train rapid decomposition changes. The highest concentration for quick break-down is appreciably below that of the weakest undiluted urine; hence it is quite impossible to obtain well-rotted dung by the use of neat urine without considerable loss.

Equally good rotting may be obtained without loss of nitrogen, as was shown by experiments in which straw was incubated with urine in different concentrations for periods up to 86 days; even after this period, the losses that occurred with satisfactory rotting and within the lower concentrations, were only about 4 % of the final nitrogen. The ordinary losses of the manure heap are frequently more than tenfold this amount.

In addition to the two phases already mentioned *a*) in which the straw supersaturated with nitrogen loses it to a definite degree, and *b*) in which straw with the requisite amount of nitrogen may undergo rotting without appreciable loss and is therefore in a state of equilibrium, there is a third phase, in which undersaturated straw exhibits a well-marked property of fixing nitrogen by the agency of micro-organisms, especially in the form of ammonia, until the same final content of nitrogen in the rotted product is attained.

As a rule, the nitrogen retained by supersaturated straw (that is to say straw containing more nitrogen than will remain in the final product), and such as is accumulated by undersaturated straw (*viz.* straw containing less nitrogen than the amount present in the final product), appears to be stored up in an organic, or non-ammoniacal form. The maximum retention of nitrogen has been found to occur within the first 4 weeks, after which the breakdown of this organic nitrogen to ammonia and the

consequent loss by volatilisation seems to keep pace with the loss of dry matter. Finally the material assumes a "stabilised" condition, the loss of nitrogen becoming greatly diminished or even absent altogether for long periods.

Between the 60th and the 120th day little change is found to take place, either in the amount of stable or fixed nitrogen, or in the proportion of this nitrogen and the ammonia which appears to be held by fermented material even at a high temperature ( $37^{\circ}\text{C}$ ), in spite of constant handling. In general it may be stated that when straw has worked from an unsaturated to a stable phase, little or no free ammonia is to be found, but straw which starts with a superabundance of nitrogen, appears to hold, when in a fermented state, upwards of 14 % of its nitrogen in the form of ammonia so long as the material is in a moist condition. Desiccation leads to almost complete loss of ammonia and in this respect, as well as in the proportion of ammonia in the moist material, the artificial manure resembles natural manure.

From the study of the inter-relations between nitrogen and straw the authors have come to the conclusion that the amount of nitrogen necessary for pronounced rotting, and the amount the straw is capable of "fixing" in the form of ammonia are identical, and that in general, the figure varies only between 0.70 and 0.75 parts of nitrogen per 100 parts of dry straw. Within these limits fermentation proceeds without loss of nitrogen, and it is obvious that except in so far as the nitrogen content of the original straw varies, the final "stabilised" product obtained when rotting has proceeded to an appreciable extent must likewise exhibit comparatively slight variation in its nitrogen content. If for example the nitrogen content of the original straw was 0.5 %, and we assume that the theoretical amount of ammonia nitrogen equal to 0.72 lb of nitrogen per 100 lb. of straw, has been fixed, then with a loss of 40 % of dry matter during fermentation, the resulting rotted straw will contain

$$(0.50 + 0.70) \times \frac{100}{60} = 2.03 \% \text{ of organic nitrogen in the dry matter}$$

The data thus obtained lead to a consideration of the process of inducing the fermentation of straw on a large scale, and can also be applied to the conditions operating in the production of ordinary farmyard manure.

As regards the preparation of artificial manure (1), experience has shown that urea and ammonium carbonate are the most suitable carriers of nitrogen, since they insure favourable alkaline reaction, and the rapid decomposition of the straw, but as they are very expensive, it is best in large scale experiments, to use cyanamide or sulphate of ammonia. While cyanamide already contains sufficient free lime to keep in check any acid compounds formed during fermentation, sulphate of ammonia must be supplemented by the addition of a base, and for this purpose finely ground chalk, ground limestone or waste lime from causticising plant at soap-

(1) This process, as well as its application to the purification of sewage has been covered by Letters, Patent, (Brit. Patent No. 152387) (Author's Note.)

works may be used. For general purposes, it will be found that upwards of  $\frac{3}{4}$  cwt. of sulphate of ammonia and 1 cwt. of finely ground carbonate of lime per ton of straw are sufficient to induce fermentation. The main obstacle to large scale operations arises from the great tardiness with which raw straw takes up the moisture necessary for fermentation. Where pits are available, this difficulty may be overcome by allowing the straw to remain immersed for 2 to 4 days, after which the free liquid may be drained off. In the case of heaps or stacks on open ground, no advantage appears to be gained by continued wetting with large quantities of water and the authors suggest sprinkling the heaps comparatively lightly with water and allowing a couple of days to elapse before repeating the operation. The slight fermentation that sets in after the first sprinkling renders the straw more capable of absorbing the water of the second. When examination has shown that the interior of the heap has become uniformly moist, the source of nitrogen may be applied in the form of solution; or in the case of cyanamide and other products, this may be broadcasted over the surface of the heap and watered in.

Artificial manure is identical in physical properties with well-rotted farmyard manure, and differs from it in chemical composition only in so far as it does not contain (in addition to nitrogen), the appreciable quantities of phosphorus and potash derived from the foods consumed by the animals. Of the three constituents ordinarily present in manure - urine, faeces and straw - the faeces appear to contribute only to the physical character of the product; and as the nitrogen they contain is inert require to be furnished with the nitrogen needed for the decomposition of the straw instead of fixing it themselves. The average of 26 analyses of the faeces of the horse, cow and sheep showed the percentage of nitrogen to be almost the same as in fermented straw, viz. 1.93. The mean content of fixed, that is to say not ammoniacal, nitrogen in manure made under controlled conditions in America and Europe proves to be 2.09 %, as a mean of 43 records. During the rotting of dung, a large amount (over 40 or 50 %) of the nitrogen contained in the food and litter is almost invariably lost, and this loss appears to fall largely or even exclusively on the urine nitrogen which is the most valuable constituent of the manure since it is the most readily available. Both chemical and physical measures have been suggested to prevent or reduce this loss, but they have either proved ineffective, or have interfered seriously with the rotting process.

If dung making be regarded as essentially a straw-rotting process, this loss is capable of explanation. It has been seen that the nitrogen-fixing power of straw is strictly limited and that any surplus nitrogen in the form of ammonia is liable to loss by evaporation. It may therefore be assumed that the practice of supplying concentrated feeding stuffs to farm livestock merely results in an increased production of soluble nitrogen, which owing to the normally overloaded conditions of the litter, is liable to relatively greater loss than where such feeding stuffs are not used.

A fairly close approximation to the actual results of a number of feed-

ing experiments may be obtained by taking the sum of: 1) the amount of nitrogen present in the litter (which is not subject to loss); 2) the amount of faecal nitrogen calculated by means of the digestion coefficients of the food consumed; 3) the nitrogen that the litter is theoretically capable of fixing (0.72 lb. per 100 lb. of straw); 4) the ammoniacal nitrogen present in the manure.

For this reason the authors advise a more liberal use of litter as a means of reducing the losses that occur in the making of manure.

F. D.

237 - **Supplies of Organic Matter in the Soil; Research carried out at the Rothamsted Experimental Station (England).** — RUSSELL, E. J. (Director, Rothamsted Experimental Station), in *The Journal of the Ministry of Agriculture*, Vol. XXVIII, No. 6, pp. 779-782, figs. 2, London, December 1921

Recent experiments emphasise the importance of having ample supplies of organic matter in the soil, although some of the older agricultural chemists were inclined to the view that artificial fertilisers were the chief source of soil fertility and all that need be done was to apply them in the required amounts. Organic matter however as supplied by farmyard manure improves the conditions for the root-crops, facilitating the production of tilth and increasing the water-holding capacity of the soil. It also improves the growth of clover, and causes less variation in yield from year to year than artificial manure; further, its use involves less risk of deterioration of soil when the course of cropping is abnormal, as in cases where the field receives an insufficient amount of fertiliser, or a manurial treatment deficient in one or more essential constituents.

*Comparison of Farmyard with Artificial Manures.  
Continuous Wheat.*

Plot No	Treatment	Average yield bush. per acre	Mean annual diminution bush per acre	Percentage of relative variance ascribable to weather
2 b	Farmyard manure, 14 tons annually . . .	34.549	0.031	2.78
3 and 4	No manure . . . . .	12.629	0.097	6.20
5	Complete mineral manure . . . . .	14.180	0.090	5.84
6	As 5 + single ammoniacal salts . . .	22.581	0.141	6.01
7	As 5 + double ammoniacal salts . . .	31.367	0.144	5.11
8	As 5 + treble ammoniacal salts . . .	35.694	0.092	4.18
10	Double ammoniacal salts alone . . .	19.504	0.157	11.10
11	As 10 + Superphosphate . . . . .	22.046	0.219	10.32
12	As 10 + Super + Sulph. Soda . . . .	28.319	0.181	7.28
13	As 10 + Super + Sulph. Potash . . . .	30.209	0.123	5.55
14	As 10 + Super + Sulph. Magnesia . . .	27.765	0.231	6.38
Alternate } 17	Mineral alone, or double ammoniacal	14.510	0.092	10.16
18	salts alone, in alternate years . . .	29.006	0.114	4.55



The following data, which represent the results of a series of experiments lasting 68 years, prove without any doubt that farmyard manure is more dependable than other fertilisers, although it is not capable of giving as good yields in favourable seasons as a properly balanced mixture of artificials.

The superiority of farmyard manure to artificials is shown by two diagrams. One proves the steadiness of its effects as compared with the effects of a complete manure, phosphatic manure, and a nitrogen-potassic and phosphato-potassic manure respectively, in increasing the yield of continuous crops of barley grown from 1852-1919. The other shows the effect of farmyard manure and of artificials on clover and wheat (grain and straw) succeeding a corn crop.

A good deal of work is being done at Rothamsted and elsewhere to discover the scientific reasons for these various effects and the best way of using farmyard manure, but in the meantime there is another and far more urgent problem, how can the supply of farmyard manure or similar materials be increased?

Two general methods are being studied at Rothamsted. The first consists in reducing the wastage in making and storing farmyard manure, which is very considerable. The second consists in actually increasing the supply of farmyard manure or like substances on the farm, either by keeping more livestock, or by adopting substitutes for farmyard manure. The success attained in the experiments in progress at Rothamsted on the decomposition of straw by artificial means makes it most probable that given a proper air and moisture supply, suitable temperature, freedom from acidity and the addition of the right proportions of soluble nitrogen compounds, a substance resembling farmyard manure can be produced.

Another method of attaining the same object is by the use of green manuring, but for this to be an economic possibility it is necessary to sow a catchcrop after the harvest. Sewage can also be used and an extensive experiment, which was carried out at Rothamsted from 1918-1920, has proved that "activated sludge" gives a fertiliser of high value (1), very considerably better than anything yet obtained. G. A. B.

238 **Physic Nut Cake as a Fertiliser.** See No. 207 of this *Review*.

239 - **The Recent Conference at Rotterdam and the Future Prospects of Nitrate of Sodium.** *Caliche*, Year III, No. 9, pp. 120-131. Santiago (Chile), December 1921.

The difficulty in estimating the consumption of nitrogenous fertilisers during the current season, and the great uncertainty prevailing as to their price, owing to the size of the stocks have naturally had the effect of arresting the anticipated demand. An important conference on the subject was held at Rotterdam on June 20, 1921, which was attended by the representatives of the Association of the Producers of Nitrate of Sodium, of the British Confederation of Ammonium Sulphate and of the German Ni-

(1) See *R.* Sept. 1920, No. 843. (*Ed.*)

nitrogen Syndicate respectively. The object of the Conference was to fix the prices of the different nitrogenous products.

It was unanimously agreed that nitrogen consumption could be greatly increased by a better propaganda and by fixing the price. It was stated, as an illustration of this fact, that the consumption of nitrogenous products had been increased 75 % in Germany in 1920, owing to the uniformity of prices, although the cost had risen to double the expected amount. During the same period, the propaganda expenses incurred by the German Nitrogen Syndicate, in Germany alone were more than twice as great as those paid by the Association for the Production of Nitrate of Sodium throughout the world. The possibility of a more energetic nitrate propaganda undertaken in collaboration with the other producers of nitrogenous fertilisers was thus clearly demonstrated and it ought to be equally feasible to associate this important branch of the industry with the production of the two other chief types of fertiliser, phosphates and potash, in order to obtain the full benefit of co-operation. Another point raised at the Conference was the question of establishing an International Credit system similar to that already instituted in Germany which allows of credit being advanced to agriculturists on the value of their crops up to 50 % of the cost of the nitrogenous fertilisers purchased which would greatly increase the consumption of fertilisers to the great advantage of impoverished land. The stock of complete fertilisers in Germany which previous to the War amounted to 450 000 tons of nitrogen as against a consumption of 200 000 tons of nitrogen in the form of nitrate of sodium and sulphate of ammonia has now fallen to  $\frac{1}{3}$  of this figure, but it is believed that by means of active propaganda the farmers can be induced to cover this deficit by the use of sulphate and nitrate of ammonia which would mean an increase of 1 500 000 tons in the consumption of these fertilisers in Germany alone. Long discussions were also held with a view to settling the basis of an agreement between the different manufacturers of nitrogenous products and the suggestion of fixing the price on the markets of consumption at 15 pounds sterling per ton met with unanimous approval, this price being considered quite fair to customers under the present conditions.

The present abnormal situation has had the result in Chili of closing many factories for the extraction of nitrate of sodium; the monthly production has therefore fallen below 100 000 tons, as against an average of 210 000 tons in the preceding year. The Chilean Government regards the situation as one of extreme gravity, for in the nitrate working centres there are already 40 000 men unemployed and if some speedy agreement is not made with the holders up of the stock, unemployment will still further increase. The Chilean Government is evidently following with the greatest interest the negotiations now in progress and has allowed it to be understood that if some agreement is not soon reached, it will be obliged to resume its liberty of action.

Owing to the fall in the exchange and the lower price of sacks and fuel, the cost of production has greatly diminished, being estimated at 6 to 8 shillings per Spanish quintal (46.02 kg.) except in certain isolated cases.

The previous sales at high prices have given the producing societies a solid position which enables them to face the present situation and even if they effect no further sales before 1922, the profits obtained up to December 1921 should leave them well content. The future of the industry is, however, uncertain, but if an agreement can be arrived at between the rival nitrogen producing companies to fix the price at 15 pounds sterling, there would be a sufficient margin of profit to cover present expenses, and more energetic propaganda would also do much to increase the receipts.

To sum up: the nitrate of sodium industry is now passing through one of the periods of crisis to which its market has always been subject, but the present situation may be regarded as temporary and due to the general economic situation, not to a change in the views of the world's consumers of nitrogen.

G. A. B.

AGRICULTURAL  
BOTANY,  
CHEMISTRY  
AND  
PHYSIOLOGY  
OF PLANTS

240 - **Studies relating to the Anatomy and Physiology of the Sugar-Cane in Cuba.** — MAMELI CALVINO, E. (Jefe del Departamento de Botánica de la Estación Experimental Agronómica, Habana), in *Estación Experimental Agronómica, Boletín* No. 10, and *Revista de agricultura, comercio y trabajo*, Year IV, No. 1, pp. 551-555. Havana, 1921.

The author gives an account of the attempts made to secure new varieties of sugar-cane by means of sexual reproduction. He criticises the methods adopted to obtain seedlings (alternate rows; castration of the flowers; self-pollination, cross-pollination with the aid of bags; cross-pollination without protecting the flowers with bags). He describes the varieties "Cristalina", "Uba" and "C 291" and their distinguishing histological characters (epidermis of the internodes, nodes and leaves; siliceous bodies; waxy covering; starch grains, hairs of the auricles and surrounding the leaf-blade). He passes on to speak of the conditions determining the flowering of the sugar-cane and gives a critical review of the results hitherto obtained by experiment from which he draws the following conclusions:

1) The methods hitherto adopted for protecting inflorescences in order to guarantee paternity in crosses between varieties of sugar-cane are insufficient to prevent the possible intrusion of foreign pollen, as such pollen is able to find its way through muslin, and even finer materials. The use of bags of paraffined paper or glass boxes entails the drawbacks of defective air circulation and rise of temperature.

It is necessary in each country to study the protective devices best suited to the local conditions of humidity and temperature. The author suggests the following method as adapted to all Experiment stations where sugar-cane is sown. A greenhouse, either fixed or movable, should be constructed above or below ground in which the crossings can be made by dusting the inflorescences of the female plants with pollen. The plants to be crossed can be grown directly in the greenhouse, or else in the open in pots or boxes, and transplanted into the greenhouse with all necessary precautions, when just about to flower. If movable greenhouses are used, they can be erected over groups of sugar-canes flowering in the field; care must be taken to prevent the entrance of strange pollen, which, however, in this case is comparatively easy.

The fixed greenhouse offers greater security; it can be divided into compartments by fixed or movable partitions, so that many crosses with different varieties can be made at the same time.

By this method all the errors inseparable from the use of bags of material are avoided and it would be possible to undertake accurate researches on the subjects of self-sterility and self-fertilisation under the best conditions for the fertilisation of the sugar-cane.

2) The macroscopic and microscopic characters of the inflorescence though hitherto generally neglected in the descriptions of the different varieties, are of the greatest importance in their identification and also in the choice of the best individuals for crossing.

3) The histological study of the sugar-cane has revealed considerable differences between very nearly related varieties.

4) The conditions causing the irregular flowering of the sugar-cane are at present unknown. It would be necessary to take into account in each district the data relating to the temperature, the hygroscopic state of the atmosphere and soil, the duration of insulations and the light intensity during both the vegetative and flowering periods.

5) In Cuba the sugar-cane usually flowers from December to March, though some varieties may flower to the end of April. At the Havana Experiment Station, there are 18 varieties that have never borne flower. On the other hand the varieties *Cristalina*, and *Uba* from Natal, and a number of seedlings obtained at the Station itself, flower every year. Of these C46 and D99 bore flowers at the age of 7 months.

6) The pollen of the sugar-cane contains a considerable amount of starch from the beginning of the formation of the pollen-grains in the pollen mother-cells, and it only disappears when the pollen-grain is about to pass down into the pollen tube.

7) Pollen grains with no starch are as a rule abortive and morphologically abnormal.

8) Among the varieties grown at the Havana Experiment Station, some have normal pollen in all their inflorescences from December to March; whereas in others the pollen is abortive in the inflorescences of February and March. On the other hand the *Uba* sugar-cane from Natal produced in 1920, inflorescences with abortive pollen from December to March, and one inflorescence with much normal pollen at the end of April.

9) Some of the inflorescences of the same variety coming from different localities may contain normal pollen, while the pollen of the others may be abnormal.

10) Sugar-cane pollen will not germinate in the ordinary cultural media; several different substances were tried, amongst them were the viscous stigmata of the flowers of *Nicotiana Tabacum* var. *havanensis* which proved quite satisfactory.

11) As a result of the microscopic examination of the pollen and pistils of 36 varieties of sugar cane, 20 crosses were made at the Havana Experiment Station, and out of the 100 seedlings produced, 16 bore fertile seed.

12) The seeds of 14 varieties believed to have been fertilised by natural pollinisation were also planted; 8 of the resulting seedlings bore fertile seed which produced 29 plants.

13) From the author's studies it would appear that the presence of starch in the styles, is not a character associated in any way with the fertility of the ovaries, for varieties like C7, C30, C37 and H109, which were found to have no starch in their styles, produced fertile seed both in the case of the naturally and of the artificially pollinated plants.

14) The present experiments of the author in Cuba, shew that the minimum time for the germination of sugar-cane seeds is 3 days, the maximum being 8 to 10 days. As a rule the seeds take 5 to 6 days to germinate in the sterilised boxes for propagation. F. D.

241 - **Notes on the Work of the Phytotechnical Station at Gayerovo (Paraná), Brazil.** - ZEDNECK and GAYLER, C., in *Boletim de Agricultura, Commercio e Industria*, Nos. 1-3, pp. 3-10. Bahia (Brazil), March 1921.

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In the selection of cereals, the following characters are taken into account: number of culms; length of culm; length of ear; number of grains per plant; weight of 1000 grains; weight in gm. of the culm, ear, grains, awns, of the second internode of the culm; total weight of grains of a single plant; density of ear; resistance coefficient of the culm and of the 2nd internode; shape of leaves, plant mass.

WHEAT - 400 plants of the Barleta variety were chosen in the first place; of these 11 were employed as heads of lines (mother plants), and the others for mass selection.

As a first result of the latter process may be mentioned Barleta, Paraná, type 1914, which gives a higher yield than the original strain.

In addition to selection work the Station has undertaken comparative cultural experiments with 3 Japanese varieties: Sgatingo, Eshima, Shiro and Shiobaya of which the first is distinguished by its early maturing: it ripens in 3 months only, this is a valuable character under the climatic conditions existing at Gayerovo.

The Station has also made pedigree selections of rye and comparative tests of some varieties of oats, in order to study their rust resistance. Excelsior (from Rio Grande do Sul), is practically immune, whereas the North American types Aurora No. 831, Fulghum No. 408, and Red Rustproof No. 518-3 were severely attacked by the fungus.

MAIZE. - Characters forming the object of examination: vigour of culm; shape of leaves; early maturity; weight of ear in gm; length of ear; circumference of the lower, middle, and upper thirds of the ear; number of rows of grains; number of grains per row; total number of grains per ear; weight of rachis in grammes and in % of whole ear; weight of grains of a single ear; weight of 1000 grains.

Selection work has been begun on Golden Dent, the variety that seems most suited to local conditions, with a view to further improving it and preserving its purity.

The female parents had been the Canipea ear, a prize-winner at the Rio de Janeiro Show, and 4 other ears chosen on the field.

The seed from the Campea ear produced plants that were already clearly superior to all the others. Comparative cultural experiments were also made with *Dr. Assis*, *Brazil*, *Horsting Prolific*, *Gerrick*, *Loveliest* and *Laguna*.

**PULSE CROPS.** — Characters investigated : number of pods per plant ; number of seeds per pod ; total number of seeds ; weight of seeds per plant ; weight of 100 seeds ; disease resistance, etc.

**PEAS.** — From the comparative cultural tests it was found that the most suitable varieties are *Burt's Early*, *Morning Star*, *Prosperity* and *Bliss Everbearing*.

**POTATOES.** — Characters investigated : total number of tubers ; total weight of tubers ; average weight of a single tuber ; mass of foliage and haulms ; disease resistance.

In the variety *Silezia* are found united in the best proportion the 3 characters : high yield, good quality and disease resistance

The selection of this variety was begun on 3 lines, Nos I, II, III.

The French beans, the cotton plant ("Express" variety), and the pea-nut were also made the subjects of experimental researches. The following 4 varieties of the pea-nut were examined : *Indios Nhambiquara* (grown by the Indians of this name), *Parccis* and *Tupis de Matto Grosso*, *Hespanhol Rasteiro*, *Red Pea-nut* and *Gayeroso*. The Indian variety is distinguished by the size of the seeds which are 4 times as large as ordinary pea-nuts.

G. A.

242 — **Hereditary Behaviour of a Dwarf Form of Barley in Japan.** — MIYAZAWA BUNGO, in *Journal of Genetics*, Vol II, No. 3, pp. 208-208, 20 plates, Cambridge, December 1921

From crossing one individual, "*F<sub>1</sub>* Goldenmelon × Sekitori", with the Goldenmelon parent, 96 offspring were obtained, one of which, a dwarf plant, was interesting as regards its hereditary behaviour.

The characters of this plant together with those of its parents, are as follows :

	Goldenmelon	Sekitori	Dwarf Plant
Height of plant. . . . .	tall	short	less than Sekitori
Rows in ear . . . . .	2	6	2
Length of awns. . . . .	long	short	long
Time of ripening . . . . .	late	early	later than Goldenmelon

Although this dwarf plant tillered more abundantly than normal varieties, over half the shoot, thus developed failed to produce ears.

In November 1915 about 40 seeds of this dwarf plant were sown, and in 1916, 24 plants were obtained, 18 being dwarfs and 6 normal (ratio : 3 : 1). In November seeds taken from 9 dwarf and 6 normal plants were sown ; in 1917 all the normal plants were found to breed true to type.

whereas the offspring from the dwarf plants contained 292 dwarfs and 161 normals (64.5 and 35.5 % respectively).

It is thus seen that:

- 1) The dwarf character is dominant.
- 2) All the dwarfs are heterozygous, for as the ratio of dwarfs to normals is approximately equal to 2 : 1 instead of 3 : 1, it is clear we are not dealing with a typical segregation.

DE VILMORIN has already studied the dwarf forms in wheat and always obtained 2 *dwarfs* as against 1 normal, so that this result might be caused by the fact that any zygote homozygous in respect of dwarfness is either not produced or dies very early.

The present case is very similar to that described by VILMORIN and in the author's opinion, might be explained by one of 2 alternatives

- 1) Seeds containing zygotes homozygous with dwarfing do not germinate (this hypothesis is excluded by the results of the germination tests);
- 2) Such seeds die soon after germination

In order to test the second hypothesis the author sowed some seeds from dwarf and normal plants in pots and placed the latter in a cold frame to protect them from severe cold. In late April he discovered among these seedlings quite a new dwarf-form (a sterile dwarf), which tillered freely (in some cases 152 shoots to a stock), but grew very slowly and produced no ears; the length of the culms was much less than in the dwarf type mentioned above. By the middle of June all these plants died as a result of the attack of *Erysiphe graminis*, whereas the other two types (the normal and fertile dwarf), had completed their growth.

Out of 323 plants there were: 71 sterile-dwarf, 172 dwarf, and 80 normal, according to the ratio 1 : 2 : 1 (80.75 : 161.50 : 80.75). In the preceding experiments, a certain number of sterile-dwarf plants must have escaped notice owing to their weak constitution which caused them to succumb to the severe cold. In a control experiment made by sowing some seeds of the dwarf plants in the early spring, so as to enable them to escape the winter, 684 plants were obtained; of these 156 were sterile-dwarf, 340 dwarf, and 188 normal, the ratio of the 3 types being approximately 1 : 2 : 1.

CONCLUSIONS. — The dwarf plant found in 1915 at the beginning of the experiments was heterozygous with respect to the character in question and was intermediate externally; *i. e.* shorter than normal, but taller than sterile-dwarf. In other words, if we denote the allelomorph for dwarfness by **D** and its absence by **d**, we have sterile-dwarf = **DD**, normal = **dd** and ordinary dwarf = **Dd**.

G. A.

243 - Svalöfs Odal, a New, Early Variety of White Oats suited to North Sweden. — AKERMAN, A., in *Skrifter Utgådötterum s, Fidskrift*, Year XXXI, Part 6, pp. 244-250, fig. 1, Malmö, December 1921

Of late years as regards oats, one of the most important breeding problems in North Sweden, was the method of obtaining a type in which very

early maturity is associated with the valuable qualities found in the Guldregn variety viz., high yield, good quality of grain and strong straw.

A type of this kind was especially needed in districts where, as Guldregn and other varieties had proved too late, agriculturists had fallen back upon inferior white sorts such as Dala and native oats. Moreover where Guldregn is already habitually grown and even in the latitude of the south of Dalarna, cold seasons occasionally spoil the crops which do not ripen properly, so that an earlier variety is desirable also in these parts of Sweden.

For this reason, selection work was carried out on an early oat from North Scandinavia, and the final result was Dala of Svalöf, a white oat ripening certainly a little before Guldregn, but with poor straw and low yield and hence not extensively cultivated

Subsequently NILSSON-LINDEL crossed Dala with Guldregn and by selecting the offspring of this cross, obtained amongst others, O 1163 *b* which was tested and at once put on the market under the name of Svalöfs Odalhavre (Svalöf's Odal). In this hybrid the good characters of Guldregn were associated in the right proportion with early maturity. Odal does not head early, but ripens quickly, so that the interval between the appearance of the panicles and the maturity of the grain is considerably shortened (See Table I)

TABLE I - *Duration of the growth period (in days) for certain lines of Guldregn Dala at Svalöf and at Holm (Ångermannland)*

Sort-	Svalöf 1912-1919		Holm 1917-1920	
	Until heading	Until ripening	Until heading	Until ripening
03861 Guldregn . . . . .	66	108	57	95
01161 from 0386 0924	66	104	—	—
01163 Odal . . . . .	65	104	56	94
0924 Selected Dala. . . . .	67	102	55	90
White oats from the north	—	—	35	90

Thus, as regards precocity Odal ranks between its parents, being earlier than Guldregn, but later than Dala

From the point of view of grain production, it yielded on an average at Svalöf 9 % higher than Dala (average 1912-1919) Odal, 34 12 quintals; Dala 31 04 quintals the best crops were obtained in the good years 1912-1913-1915-1916, whereas in 1914 and 1917, years of severe drought, the yield was somewhat low

Thus the new type would appear to have inherited specifically high productivity from Guldregn, but to have lost, at least to some extent, the capacity (peculiar to Dala) of giving a high yield, even under less favourable climatic conditions

On the other hand, it produces less straw than either Dala or Guldregn, this is due to the shortness of the culms (Odal 41 76 quintals; Dala



45.06 quintals; Guldregn 44.16 quintals). Similar results were obtained at the Sub-Station of Ultuna (Domnarfret territory) as well as in the district of Kopparberg, where Odal proved itself superior to the black oats Björn and Orion, both as regards grain and straw

At the Sub-Station of Varpnas (South Varmland), Odal has surpassed Guldregn two years out of three, and very encouraging results have been obtained in the district of Gävleborg where this kind of oats is being more and more cultivated.

Table II gives the data of a series of cultural experiments made at Holm, in the southern part of Ångermanland.

TABLE II. — *Straw and grain yield per hectare of several types of oats at Holm (Ångermanland) in 1917-1920.*

Type of Oat	Average		Yield as compared with that of Guldregn = 100	
	Grain	Straw	Grain	Straw
0386 Guldregn . . . . .	2948 kg	3920 kg	100.0	100.0
01163 Odal . . . . .	2050	3778	100.0	96.4
0924 Selected Dala . . . . .	2820	3928	95.7	100.0
White Oat of the North . . . . .	2655	3773	90.1	96.4
01163 d of 0386 0924 . . . . .	3313	4273	112.4	109.0

It should, however, be mentioned as regards the data of Table II, that Holm is situated in a very favourable position; therefore it would not be wise to apply the conclusions to all the district of Ångermanland and to the northern part in particular where the duration of the growth period is much reduced.

The introduction of Odal into Vasterbotten must be limited to the most favoured portions of the province. This variety is too late for Jamtland and should not be introduced.

As regards the strength of the straw (resistance to lodging), Odal proved itself distinctly superior to Dala, and nearly equal to Guldregn in the practical tests made at Svalöf (See Table III)

TABLE III. — *Comparative resistance to lodging of Odal and other types of oats.*

Sorts	Degree of strength of Straw 10 = remains quite erect 1 = laid even with the ground	
	1918	1919
0386 Guldregn . . . . .	7	9
01161 c, from 0386 x 0924 . . . . .	—	7
01163 b, Odal . . . . .	6	8
01163 d, from 0386 x 0924 . . . . .	—	8
09241 Selected Dala . . . . .	3.5	5

In its general morphological characters, Odal is very similar to Guldregn; its grain is of fine yellow colour, and is slightly larger than that of Guldregn. Table IV gives the weight per hectolitre of 1000 grains and the % weight of the grains.

TABLE IV. — Characters of the grain in some lines from the cross Guldregn × Dala According to the Data Collected at Svalöf, Domnarvet and Holm.

Varieties	Svalöf 1912-1919			Domnarvet 1913-1919			Holm 1917-1919		
	Weight of 1 hectolitre in kg.	Weight of 1000 grains in gr.	Percentage of grain	Weight of 1 hectolitre in kg.	Weight of 1000 grains in kg.	Percentage of grain	Weight of 1 hectolitre in kg.	Weight of 1000 grains in gr.	Percentage of grain
0386 Guldregn . . .	53.0	30.6	75.3%	54.9	32.6	76.2%	40.5	34.0	73.2%
01161 from 0386 × 0924 . . . . .	50.8	29.4	73.0	52.6	30.9	75.1	—	—	—
01163 Odal . . . . .	50.5	29.7	72.9	51.7	32.8	75.4	40.9	35.1	71.9
0924 selected Dala White Oats from the North . . . . .	50.0	27.2	72.3	51.1	28.7	73.9	41.9	31.4	71.8
	—	—	—	—	—	—	39.4	27.1	67.8

The grain percentage and weight of 1 hectolitre are slightly less than in the case of Guldregn, but higher than in Dala.

From the results obtained, it may safely be said that the object of the selection processes have been to a large extent attained. The aim was to obtain an earlier type than Guldregn, but possessing its excellent qualities. It is true that in this case as in most crosses it was not possible to unite the positive characters in the degree in which they were present in the parent plants.

The result is, however, eminently satisfactory and the new variety can well be used instead of Dala as a substitute for Guldregn in districts where Guldregn has been found to ripen too late.

G. A.

244 - The Inheritance of the Character "Yellow Striping of Leaves" in the Oat. — CHRISTIE, W., in *Zeitschrift für Indukative Abstammungs und Vererbungslehre*, Vol. XXVII, Part. 2, pp. 134-141, 1 fig. Leipzig, December 1921.

The author in 1914 found in a pure line of oats "Moistad Grenadier" (isolated in 1906), a single plant with well-marked longitudinal yellow stripes on its leaves and even on the glumes.

In 1915 he obtained by self-fertilisation, 8 striped and 2 green individuals. None of the latter bore seed capable of germinating; on the other hand, 3 of the former plants produced offspring forming a total of 24 green and 19 striped individuals (1916).

In 1917 out of the 14 green 1916 plants, 5 had green progeny, and the descendants of the others segregated into green and striped specimens; whereas out of 7 of the striped plants, 2 had striped descendants and the others had both green and striped offspring.

As regards the segregation proportions, these varied greatly from one plant to another : the totals were :

In the progeny of green plants : 302 green and 112 striped.

In the progeny of striped plants : 33 green and 98 striped.

This work was continued in 1919 and 1920

The results obtained during the last year may be briefly summarised as follows :

*Summary of the results obtained in 1920.*

Colour of the leaves of the mother-plants	No. of plants in 1920		Colour of the leaves of the mother-plants	No. of plants in 1920	
	Green	Striped		Green	Striped
<i>Green</i> (constant)			<i>Striped</i> (segregating)		
Total for 66 numbers	1674	—	No 8 . . .	9	11
<i>Green</i> (segregating) .	6	—	" 104 . . .	4	2
Total for 20 numbers	68	—	" 71 . . .	1	—
No 53 . . .	2	2	" 73 . . .	—	3
" 148 . . .	4	2	" 103 . . .	—	2
" 150 . . .	6	11			
Total for these 3 numbers	12	15	Total for these 5 numbers	14	18

The green type therefore only exceptionally splits up into green and striped descendants, and in very variable and indefinite proportions. As a rule the striped individuals out-number the green. Some of the green plants resulting from segregation are fixed, while the others are liable to segregation. The *striped* type can give rise to the *green* by segregation and the green type in turn can produce the *striped*. This phenomenon, together with the variation in the ratios of segregation makes it probable that this character is not Mendelian but similar to that already discovered in other plants by BAUR, CORRENS, and IKENO and MILES.

The author proposes to investigate the matter still further by crossing the striped with the normal type.

G. A.

245 - **Inheritance of the Character, Crinkly Leaf, in Maize.** J. MURSON, R. A., in *The Journal of Heredity*, Vol. XII, No. 6, pp. 267-270, figs. 3, Washington, July 1921

From crossing a strain of Dent maize with a strain of flint maize, a type with crinkly leaves was obtained in the  $F_2$  generation. The crinkly individuals are usually about  $\frac{2}{3}$  the normal height, the tassels are relatively short and compact, and not infrequently bear numerous seeds ; often part of the central spike of the tassel is more or less ear-like. The upper leaf-blades are relatively short and broad and frequently have prominent lobes near the base ; the crinkles are perpendicular to the median nerve.

Crosses between normal and crinkly individuals invariably give normal  $F_1$  plants, and in the  $F_2$ , normal and crinkly plants in the 3:1 ratio.

Therefore probably this character of crinkled leaves depends on a single Mendelian recessive factor according to the scheme of a monohybrid. G. A.

- 246 - **A Sectorial Chimera obtained, by Crossing Two Varieties of Maize in India.** — KHADILKAN, T. R., in *The Journal of Heredity* Vol. XII, No. 6, pp. 284-285, 1 fig. Washington, July 1921

At the farm of the Agricultural College, Poona, crosses were made in 1920 between two varieties of maize known as Canada Red No. 5 and Amber Pearl pop-corn No. 8, one cob being obtained which duly ripened.

Out of a large number of plants grown from the seeds of this cob there was one in the  $F_1$  generation which grew to the height of 6 feet and had one tiller. One vertical half of the plant and of the tiller was normal, while the other presented the following characters.

1) In all the leaves half the lamina bisected by the mid-ribs was normal; the other bearing yellow and whitish stripes.

2) The leaf-sheaths and stem were also striped in the same manner.

This plant is an excellent instance of sectorial chimera which the author proposes to study further in the  $F_2$  generation. G. A.

- 247 - **A Case of Dimorphism in Rice Connected with Segregation Phenomena.** — PARNELL, T. R., in *Journal of Genetics*, Vol. II, No. 3, pp. 209-212, plate XXI, Cambridge, December 1921.

The inheritance of the so-called *glutinous* character which is typical of a small group of cultivated varieties of rice has been the subject of special study for several years. The glutinous type differs from the ordinary *starchy* type chiefly in forming a sticky mass like glue when it is boiled. Microscopic examination of sections of the two kinds of rice shows no marked difference between them, though they are readily distinguished by their colour reaction. The starchy grains when treated with iodine take on the usual deep blue colour, whereas, the glutinous grains become reddish, passing through wine-colour to dark brown as the strength of the solution is increased.

In inheritance, the glutinous character behaves as a simple recessive, but since double fertilisation takes place, the usual complication of results is obtained. Thus, flowers of a glutinous plant fertilised with starchy pollen produce flowers with starchy endosperm. An  $F_1$  plant on being selfed, bears a mixture of starchy and glutinous grains, giving rise in the  $F_2$  to 3 groups of hybrids bearing respectively: 1) all starchy grains; 2) all glutinous grains; 3) a mixture of starchy and glutinous grains. The two first groups remain constant in the  $F_2$  and succeeding generations, whereas the third produces mixed progeny also formed of 3 groups of individuals.

The mixture of grains in an  $F_1$  plant should give a simple 3:1 ratio of starchy to glutinous. In fact on 9 plants, 5292 starchy grains and 1587 glutinous grains were counted (theoretically the figures should have been 5759 and 1720). In the  $F_2$  generation each individual of the three groups

of plants would be expected to give a 1 : 2 : 1 ratio of starchy seeds : mixed seeds : glutinous seeds. In the 81 families so far raised there is a very considerable departure from this ratio in favour of the starchy grains the numbers found being 9211 : 13 729 : 5021, instead of 6990 : 13 980 : 6990 as was expected.

The author has made the important discovery that the  $F_1$  plants have two different types of pollen. One on being treated with iodine, gives the dark blue reaction of ordinary starch, and the other reddish reaction of amylo-dextrine. The pollen of the starchy parent gave the blue reaction and that of the glutinous parent the reddish.

A careful study of the proportion of the 2 types of pollen in the anther (18 anthers from 3 plants having been examined), showed that the proportion of starchy pollen varied from 43.2 % to 51.8 %, the average being 48.1 %.

There can be no doubt that the two types recognisable in the  $F_1$  pollen represent the two genetic types produced by segregation. The author proposes continuing his researches with a view to determining at what stage in spermatogenesis the segregation takes place and considers that this line of work offers distinct possibilities whenever microchemical tests are practicable, especially if such dimorphism can be found in species in which the pollen grains remain united in tetrads.

G. A.

248 - **On the Fixity of Characters in New Hybrid Potatoes.** — SCHRIBAUX, in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol VIII, No 4, pp 81-82, Paris, January 1922

AUMOT, who is continuing his researches on new potato hybrids obtained from seed has found that in certain cases the qualities (characters), of the parents are intensified in the hybrids.

Many of the latter when propagated from naturally fertilised seed have proved very stable.

A hundred individuals belonging to line No. 120 (Beurre  $\times$  Bolivienne 10 bis 1919) possess all the characters of their parents, luxuriant, strong-growing foliage, the shape and pink skin of Bolivienne 10 bis and the yellow pulp of Beurre.

In 1921 when the ordinary varieties produced tubers for the most part unfit for "seed", the hybrid potatoes were entirely satisfactory in this respect.

Some types were wonderfully resistant to the drought and at the same time very productive. The yield of some of the hybrids raised from seed often exceeded 1 kg. per clump; No. 90, the most prolific, produced 1 300 kg. per clump; some of the tubers weighed as much as 340 gm. each.

These results are really remarkable; they are especially striking, because in 1920, some of the hybrids proved to be immune to *Phytophthora infestans*, which shows that it is possible to obtain types uniting superior qualities with resistance to this destructive parasite.

G. A.

- 249 - **Pure Line Selection of the Bundelkhand Cottons in India.** — BURT B. C. and NIZAMUDDIN HYDER, in *Agricultural Research Institute, Pusa, Bulletin* No 123, pp 1-15, Calcutta, 1921

This paper gives an account of a series of pure line selections made with a view to improving the native cottons of Bundelkhand and of obtaining types of better quality able to resist the excess of moisture in years of heavy rainfall.

Three native cottons were selected for detailed study: *Rath*, *Kulpahar* and *Jalaun*. These were evidently populations made up of types differing greatly as regards flower-colour, leaf-shape, habit-quality, of lint etc.

The two first proved a disappointment, but a good selection, eventually known as J. N 1, was obtained from *Jalaun*. It had a staple of 0.85" to 0.90", a ginning percentage of 36 %, and proved very resistant to adverse atmospheric conditions

G. A.

- 250 - **Male-Sterility in Flax, Subject to Two Types of Segregation, Ambilateral and Unilateral.** — BARTON, W., and GARDNER, A. I., in *Journal of Genetics*, Vol II, No 3, pp 261-275, Plate XXIV. Cambridge December 1911

In 1912, a plant of *Linum usitatissimum* was isolated. It differed from the normal type in flowering about 10 days later and its procumbent habit; the stems reached about 2 ft in length, lying at first flat on the ground, turning upwards as flowering begins and finally standing more or less erect.

This blue-flowered procumbent type was fertilised in 1916 with pollen from a tall white-flowered fibre-flax. The  $F_1$  generation was erect and intermediate both in height and colour.

In the  $F_2$  generation the authors found certain plants having more or less completely aborted anthers. The authors were never completely sterile although sometimes little good pollen was produced. From this pollen a few seeds were obtained by self-fertilisation which gave rise to male-sterile individuals only.

Subsequent experience proved that the new form was brought in by the pollen of the common flax, and that the procumbent is genetically hermaphrodite on both the male and female sides. Twenty-four flax-fibre plants of various kinds, when tested, by using their pollen on male-sterile individuals, gave in all 640 plants all with imperfectly developed anthers. To these 24 plants may be added the white-flowered individual (which had been crossed in 1916 with the procumbent type) and a tall blue plant.

From the evidence of these 26 plants it is to be concluded that the fibre-flaxes are generally if not always heterozygous in respect of the male-sterile allelomorph, and that in segregation, this allelomorph is relegated to the male side.

The procumbent type itself is clearly hermaphrodite in genetic composition; by using the pollen of the procumbent type in crosses with normal flaxes, the authors obtained in  $F_2$  hermaphrodite offspring, and from crosses with the male-sterile type, 101 hermaphrodites and 2 male-steriles.

The latter may safely be assumed to have arisen by self-fertilisation the mother-plant not having been emasculated.

When, however, the procumbent type is used as mother,  $F_1$  is hermaphrodite, and in  $F_2$  the male-steriles appear as 1 in 4. It would appear therefore that the female side of the procumbent must be different in constitution from the female side of ordinary flaxes.

In heterozygosis with the female of the procumbent, the dominant factor for anther-development passes with its negative allelomorph to both the male and female organs of the offspring, thus producing an ordinary Mendelian result. When however the negative allelomorph is in heterozygosis with the female side of the common type, it passes wholly to the pollen of the offspring.

The transmission of characters from one side alone (the paternal or maternal), is a matter of great importance from the genetic standpoint. The authors suggest the term *unilateral* for segregation which carries the allelomorph wholly to one sexual side, and *ambilateral* for the segregation which takes place in ordinary Mendelian distribution. G. A.

251 - Contribution to the Study of Bud Variations of Economic Importance in the Sugar Cane. -- BARKER, F. F., in *The Journal of Heredity*, Vol. XII, No. 6, pp. 171-174, fig. 1, Washington, July 1921.

After speaking of the frequent occurrence of bud-variation in the sugar-cane, especially as regards a superficial character like colour, the author dwells upon the importance of making a systematic study of qualitative characters such as sugar content etc., which can only be detected by chemical analyses and experimental tests.

Certain strains of "Cristalina" differ from one another in height and cane-diameter, and consequently in yielding power. Thus cane fields, even though carefully planted for a single variety, may include more than one strain differing in season of maturity, sugar content of juice and other important economic characters which will affect the financial returns.

As to differences in resistance to disease, there are many noteworthy examples. Yellow Caledonia, Cavangire and Demerara 625 resist the so-called "root-disease" comparatively well, while Otaheite and many others succumb to it. Otaheite, Calancana, Cristalina, and Rayada are most susceptible to gummosis while Yellow Caledonia and Cavangire are strongly resistant, perhaps immune to it.

Otaheite is much injured in Australia by the ravages of the white grub and suffers from the disease known as matizado (mosaic), to which Uba and others of the North Indian type of canes are immune. G. A.

252 - Breeding Experiments with Roselle, *Hibiscus Sabdariffa*, in India. - See No. 227 of this Review.

253 - The Possibility of Determining the Value of Seed by Biochemical Means. -- NEMEC, A., and DUCHON, P., in *Comptes rendus de l'Académie des Sciences*, Vol. 173, No. 20, pp. 933-935. Paris, November 11, 1921.

The authors have studied the relations between the vitality of seeds and their diastasic activity with a view to ascertaining the possibility of

determining the agricultural value of seeds (especially their germinating capacity and energy), by a rapid and at the same time easy, biochemical method offering greater advantages than the germination test which is sometimes a lengthy process, lasting 5 to 30 days (seeds of forest trees), according to the species.

They have investigated the relations of the various diastases (amylase, invertase, glycerophosphatase, lipodiastase, urease, uricase, phytoprotease and catalase of seeds), to the vitality of seeds of different species (maize, white mustard, soy-bean), varieties, and origin.

The results have shown that the action of hydrolysing diastases can survive the germinating capacity of the seed. The catalase behaves in a totally different manner; it would seem that the lost vitality of the organism is intimately connected with the impaired activity of the catalase. It is well-known that this enzyme is extremely sensitive to the hydrogen ion; possibly the chemical changes taking place in the seed, which are characterised by the progressive acidification of the organism, bring about the gradual cessation of the activity of the catalase; in dead seeds this activity seems to be almost completely at an end. The small amount of oxygen released in this case may be attributed to the action of mineral catalysts or to the colloidal substances present in the seed.

It is evident, that the activity of the catalase, as measured by the cubic centimetres of oxygen liberated, affords an excellent means of quickly and easily determining the agricultural value of seeds. The estimate can be made in a few minutes. It only now remains to fix the limits for the practical application of this vital test.

F. D.

**CEREALS  
AND  
PULSE CROPS**

254 - Varieties of Wheat Cultivated in the Province of Cagliari, Sardinia. - BLANDINI, F. (R. Cattedra Ambulante di Agricoltura di Cagliari), in *l'Italia Agricola*, Year 58, No. 12 pp. 309, 1 coloured plate. Pissanello, December 15, 1911.

The Miocene soils of Trexenda and Marmilla, the alluvial soils of Campidani and Sulcis and the Plateaux of Planargia and Sarcidano, which form the chief wheat-growing areas of the province, produce hard wheats equal in quality to any in the world. Soft varieties are, however, little known, for the few that have been imported ended by becoming hard wheats as a result of the climate, soil and natural intercrossing with the local types.

The Sardinian peasant prefers hard wheat to soft, as it is less inclined to shed its ears or its grain, which allows the harvesting to be protracted, which is a great advantage in a relatively sparsely populated region with 25 inhabitants to the square kilometre, of whom only 6 to 7 are peasants.

The variety that best meets the requirements is "trigu murru" (whitish wheat). It is in fact grown on  $\frac{4}{5}$  of the wheat area of the province. Afterwards come in descending order, "trigu biancu" (white wheat), "trigu arrubiu" (red wheat) and "trigu moru" black wheat.

TRIGU MURRU. — This variety, when sown from the second fortnight of October to the end of December, according to the season, ripens the first fortnight of June on the coast and in the Campidani, and in the last fortnight of June, or the first fortnight of July, in the hill zone and on the plateau.



It is resistant to lodging and tillers freely: 75 to 80 kg. of seed are planted per hectare.

This wheat is especially adapted for macaroni etc.

Its characters are as follows: ear rectangular, awned, blackish-yellow, 23-25 fertile, closely-growing spikelets.

Spikelets with 3-4 fertile flowers.

Glumes oval, lanceolate, with sharp strong keel; terminates in a short pointed beak, black spots on the edges.

Palea, oval, inflated, terminating in blackish-red awns, that fall off at maturity in favourable seasons, but are otherwise persistent. Seeds oval, slightly convex, pointed, of a fine wheat colour and with straight central section.

Average length 8 mm., breadth 2-5 mm.

Culms full throughout their length, strong.

F. D.

255 - **Experiments with Wheat Varieties in India.** — See No. 227 of this Review

256 - **Mansholt III, a Variety of Oats Resistant to Lodging.** — DESPREZ L. (Directeur de la Station expérimentale agricole de Cappelle, Nord), in *Journal d'Agriculture Pratique*, Year 1, No. 3, p. 107, Paris, February, 1922

The author reports the very satisfactory results he has obtained with Mansholt III. This variety of oat was obtained by selection from Victoire de Svalöf by Prof. MANSHOLT of the Royal Netherland College of Wageningen (Holland).

Its chief characteristics are: fairly short, very thick, stiff straw, with panicle; white, plump grain like that of the Victoire variety, but distinctly larger; matures early ripens well in good seasons, the weight per hectolitre is 52 to 53 kg. As Mansholt III does not tiller it must, be sown closer.

"It is an excellent oat, very resistant to lodging; it should not be grown on poor, light soils, but it is very suited to rich, liberally manured land".

F. D.

257 - **The World Production of Soya.** — *Osten-Verden in Ostasien*, Year VI, No. 22, p. 254, Amsterdam, November 22, 1921

The most recent returns for the world's production of soya are as follows (in tons): China 3 352 400; Japan 430 933; Corea 348 000, United States 58 000; total 4 189 333 tons.

In 1918, Japan absorbed 77% of the Chinese production, America and Europe 7%, China 16%.

In 10 years the soya oil exported from China has risen from 25 000 tons to about 400 000 tons. Before the War, this oil was sent to England, the United States, Belgium, Japan, and Russia. During the decade, the exports of soya-cake has increased from 400-500 tons to over 1 million tons.

G. A. B.

258 - **Forage Production in Southern France and North Africa.** — TRUBET, L., in *Le Progrès Agricole et Viticole*, Year 38, No. 43, pp. 300-308, No. 44, pp. 425-428, No. 45, pp. 451-453, Montpellier, October and November, 1921

In the opinion of the author these regions could become stock-breeding centres, for they possess a climate that is favourable to the rapid and

FORAGE  
CROPS

luxuriant growth of many species of plants and renders it possible to dispense wholly or at all events to a large extent, with stabulation, greatly to the advantage of the health of the cattle.

As a result of experiments carried on for 25 years, TRABUT is able to state that all the best forage plants that would be useful in Southern France and North Africa have by no means as yet been introduced or exploited to their fullest extent. The family of the Gramineae can furnish a very large number of species suitable for stock-feeding and capable of growing in very different climates. The author in his rapid review especially mentions the following ;

*Maize*: innumerable forms of this cereal are cultivated ; it would be necessary to choose the best type for each farm ; selection might be of great assistance in this respect.

*Euchlaena* or *Rcana*, known under the name of " Teosinte " a genus nearly-related to maize giving abundant and excellent forage. As the seed is rare and expensive, this plant is not generally grown, but it thrives in the French colonies, and its production might be increased. On irrigated soils, the Teosinte tillers well ; the amount of seed used is relatively small.

*Tripsacum*. This genus, which came from Central Africa, furnishes perennial forage plants giving a high yield " Zacate prodigio " on the poorer soils of Mexico and Cuba. *Tr laxum* is still under observation in Algiers. *Tripsacum* can fertilise Teosinte and the resulting hybrid is exactly similar to *Tripsacum*. A plant of this section that might prove interesting is *Coix Lacryma-Jovis*, var *Mayuen*, in the Far East, it is grown under the name of " Adlay " and bears soft seeds used as a cattle feed, the straw is plentiful and forms an excellent forage.

Among the different species of *Saccharum*, the Japanese cane grows easily from slips and shoots vigorously throughout the summer until the first cold sets in. In 1920 it yielded 140 tons of forage per hectare at the Ferme Blanche. This plant needs irrigation but can stand a considerable amount of salt in the soil.

*S biflorum* quickly attains the height of 3 metres. It supplies a tough forage which is chopped is readily eaten by stock, but it is improved by being made into silage. This plant is propagated by cuttings 30 to 40 cm in length which are planted in the sand in the spring or autumn. It would be suitable for dunes and a good paper can be made from it.

*Mischantus* (*Fulalia*), a perennial propagated by cuttings, makes good forage. *M. condensatus*, a Japanese variety, produces heavy crops at the Experiment Stations in Algeria.

The forage sorghums are very numerous. Sudan Sorghum (*Sorghum exiguum* Forsk), has slender stems and makes good hay ; it resists drought well and will produce large crops in summer without irrigation. This plant is also eaten fresh and may be mixed with soya. It requires a certain amount of heat ; must not be sown before April ; tillers well ; 15 kg. of seed per hectare sown in rows are sufficient. *S. exiguum* can be crossed with the other cultivated sorghums but the hybrids, though yielding larger crops, are coarser. Hence it is better to use *S. exiguum*

for hay, and feed the hybrids to stock fresh. Sorghums contain a small amount of hydrocyanic acid ; the glucoside giving rise to it disappears at the flowering season and when the plant after cutting has wilted for lack of water. The author has never heard of any bad effects following the use of *S. exiguum* and under favourable conditions this crop can last for several years.

The *Paniceae* tribe supply a large number of forage species suitable to hot and somewhat arid countries *P. molle*, *P. maximum* and *P. miliaceum* may be mentioned.

The different varieties of *Paspalum*, plants native to America, make excellent forage (*P. virgatum* and *P. dilatatum* where the soil is damp). A few tufts are sufficient to insure its spreading without any fear of invasion. Two cuttings of hay can be taken or the field grazed winter and summer.

The various species of *Setaria* (Italian millet, Moha), are very common. The very drought-resistant types from S. Africa and America have yet to be studied. The genus *Pennisetum* has long been known. Two perennial African species are very productive and make excellent forage : *P. purpureum* and *P. Merkeri* (propagated by the Botanic Service of Rhodesia). Most satisfactory results have been obtained from them in Algeria, their crops being much heavier than those produced by the various kinds of maize and sorghum.

*P. purpureum* is sterile and is propagated either by fragments or cuttings. A cutting planted in April throws up 50 stems over 3 metres in height by October. Thus the plant is propagated very rapidly. The cutting consists of a piece of the stem with an eye ; it is put into the ground obliquely.

*P. purpureum* requires much water and heat. In Cuba, 500 tons per hectare of excellent forage have been obtained from it. The crop at Algiers may be estimated at 250 tons. *P. Merkeri* can be grown without irrigation.

*Leersia hexandra* which belongs to a genus nearly related to rice and grows wild in North Africa, does well on the banks of rivers or streams. Under the same conditions *Zizania aquatica* produces a heavy forage crop, As its seeds are difficult to keep, the better plan is to plant a few specimens which spread rapidly.

The *Phalaris* are very plentiful throughout the Mediterranean region and often constitute the basis of the forages. *Ph. stenoptera*, of Australian origin and doubtless a hybrid, is an important member of the tribe. It attains a good height, is rust resistant and forms an excellent spring forage being much superior to the native varieties.

The *Agrostis* can be cultivated on damp clay soils.

Excellent results could be obtained from carefully selected varieties of *Phleum*. *Oryzopsis miliacea*, or *Milium multiflorum* is a perennial producing much seed, it stands a high degree of salinity in the soil, is drought resistant and yields 20 to 30 tons per hectare (in several cuttings). *O. Thomasii* a stronger species which can be used associated with *O. miliacea*, grows on the Côte d'Azur.

*Avena sterilis* is hardier than *A. sativa* and does well in southern countries. Algerian oats tiller freely and when mixed with Alexandrian clover, form a forage of the first quality in winter and spring.

*Cynodon dactylon*, the Dog's-tooth Grass can be propagated in the sands; *Chloris Gayana* is however the more satisfactory; it is an African species with a very extensive area (from Tunisia to Rhodesia). This variety of *Chloris* is a perennial; it puts out long stolons that run along the surface of the ground and send down roots at the nodes. Light soils suit this plant best. *C. Gayana* produces a large crop of excellent forage and can be extirpated from any ground it has invaded.

The *Eleusineae* produce large forage crops and bear much seed.

Among the *Festuceae*, *Festuca elatior*, a wild variety, takes the first place. The author reports *F. pratensis* from the northern districts, *F. arundinacea* from the southern and *F. Fenas* from the salt steppes.

*Bromus unioloides* (Schrader's Brome-Grass), an American variety, produces early forage and stands until the autumn.

In Australia small-seeded wheats (Lambrig) are used for forage.

The many forms of *Lolium* yield good forage. Heavy crops can be obtained in the southern regions from the Leguminosae which should be grown in association with the Gramineae. P. C.

259 - A New Fodder Grass from Uganda, *Pennisetum polystachyum*. — In *Bulletin of the Imperial Institute*, Vol. XIX, No. 3, pp. 295-296. London, 1921.

The grass identified as *Pennisetum polystachyum* Schult. recently submitted to the Imperial Institute, London, for examination with reference to fodder value consisted of plants of pale greenish-straw colour, from 26 to 45 in. long and bearing immature seed heads. The material contained 7.4 % of moisture. The percentage composition is shown as follows, expressed on the moisture-free material, in comparison with the corresponding figures recorded for elephant grass (*P. purpureum*) and timothy grass (*Phleum pratense*).

The sample was found to be free from cyanogenetic glucosides.

From the above figures it may be noted that the *P. polystachyum* grass from Uganda contains a slightly higher percentage of protein than that

	Crude proteins	Fat	Carbo- hydrates (by dif- ference)	Fibre	Ash	Nutrient ratio	Food units
<i>Pennisetum polystachyum</i> . . . . .	9.9 %	2.7 %	38.6 %	40.1 %	8.7 %	1 : 4.5	70
<i>P. purpureum</i> . . . . .	10.5	1.5	41.4	38.8	7.8	1 : 4.3	71
<i>Phleum pratense</i> . . . . .	7.6	0.8	45.3	38.7	7.6	1 : 6.2	66
	8.1	3.1	52.6	30.7	5.5	1 : 7.4	81

present in timothy grass and also compares satisfactorily with *P. purpureum*. M. L. Y.

260 - Cultivation of Lucerne in the Monsoon Districts in India. — See No. 227 of this Review.

261 - **Alfalfa Production under Irrigation (1) Experiments in the United States and in New South Wales.** — I STEWART, G., Alfalfa production under irrigation in *Utah Agricultural College Experiment Station, Circular No. 45*, pp. 3-48, tables VII, figs. 13. Logan, Utah, May 1921. — II HARRIS, F. S., and PITTMAN, D. W., The irrigation of alfalfa, in *Ibid. Bulletin 80*, pp. 3-30, figs. 2. Logan, 1921. — III. CHOMLEY, F. G. and CHAFFEY, F. A., Producing Lucerne Hay under Irrigation, in *Dept. of Agriculture New South Wales, Farmers' Bulletin No. 143*, pp. 3-22, figs. 19. Sydney, Oct. 1921.

I-II. — Field and tank experiments on the irrigation of alfalfa were conducted at the Utah Experiment Station, U. S., and apart from the general methods of cultivation employed which are described in detail the following results are worthy of special note.

The best results were obtained when irrigation water was applied in 3 to 5 heavy applications on loams or clay loams, but in 4 to 10 frequent, light applications on porous soils. In these experiments the yield generally increased as the total amount of water applied increased up to 90 acre-inches (the highest amount applied), but the gain in yield from the application of more than 30 acre-inches was too small to pay for the extra labour; 25 in. applied in weekly quantities of 2.5 in. gave better results than 30 in. where 5 in. was applied each alternate week. With an equal amount of water, frequent moderate applications gave better yields than fewer heavy ones.

Where irrigation was not practised, 55 % of the entire yield came from the first cutting and 14 % from the third. Where regular quantities were applied each week, from 33 to 37 % of the crop came from cutting I, from 37-39 % from cutting II and from 25 to 30 % from cutting III.

The relative yields of the different cuttings were to a certain extent changed when the water was applied at various times; but this did not affect the total annual yield consistently.

Apparently the yield was highest when the soil moisture content was kept constantly at 25 %.

III. — Alfalfa growing for hay has for some years become a feature of some importance on the Yanco Experiment Farm in New South Wales, and so profitable that the area has been considerably extended; there are now 120 acres under crop with an average of 6 or 7 cuts per season. Speaking generally, one irrigation for each cut has been found sufficient in the early part of the season, but later an average of two per cutting. Irrigation takes place a week before cutting; a second watering is given as soon as the hay is taken off. A big body of water is never turned on the alfalfa at one time. The head ditch is filled and then a gap is opened in the bank about half way between the check banks, allowing enough water to escape to spread from bank to bank, just covering the surface and moving forward very slowly. It should take from 6-8 hours for the water to reach the lower end of the block 6 chains away, by which time the water can be shut off at the upper end. This method is adaptable to heavy soil but on lighter

(1) See R Aug. 1917, No. 813; R May 1918, No. 507; R Oct. 1918, No. 1082; R May 1920, No. 496. (Ed.)

soil, the flow can be somewhat faster. It is considered imperative that facilities be provided for thorough surface drainage, as water lying on alfalfa for 3 hours on a hot day will do irreparable damage to the stand

Apart from the details with regard to irrigation methods employed in New South Wales, the authors give an interesting description of the hay machines etc used, and certain cultural details. M. L. Y.

262 - **The Chemical Composition of Mangolds. Analyses Made in New South Wales.** - RAMSAY, A. A., in *The Agricultural Gazette of New South Wales*, Vol XXXII, Pt II, pp 819-821, Nov 1921

Results of analyses made at Grafton Experimental Farm, Glen Innes Experiment Farm and Hawkesbury Agricultural College, Richmond.

An average of the total analyses made in connection with the recent trials in New South Wales shows the mean composition of the mangold to be as follows: % moisture, 92.01, albuminoids, 0.99; ether extract, 0.04 fibre, 0.77, ash, 1.37, nitrogen free extract, 4.80

According to the comparison table showing the ranges in variation of composition for all the varieties grown at the 3 different State institutions, and those of English mangels, the ranges in the percentage composition are apparently much greater in the mangels grown in New South Wales. The percentage composition of the dry matter content is also very variable, e.g. albuminoids 7.41 to 22.26 %, ether extract 0.16 to 0.99, fibre 2.28 to 18.86 %, ash 6.74 to 36.38, nitrogen free extract, 32.04 to 83.40 %

An interesting aspect of the investigations has been a consideration of the variation between the average composition of 8 selected varieties of mangels grown under widely differing conditions, and on the other hand, of the variation when grown alongside one another at any one of the farms. A similar comparative variation is noted as regards the percentage of dry matter content of these 8 varieties shown as follows

	Variety												
	Sugar	Yellow Globe	Golden Tankard	Mammoth Long Red	Golden Globe	White Sugar Rose Top	Giant Half Green Top	Purewinner	Average	Grafton	Glen Innes	Haw- kesbury	Average
	%	%	%		%	%	%	%	%	%	%	%	%
Albumin-													
oids	6.47	5.00	4.12	2.08	7.07	0.50	3.91	3.74	4.11	11.37	7.05	11.67	10.03
Ether ex-													
tracts . .	0.51	0.31	0.64	0.88	0.21	0.22	0.60	0.41	0.47	0.84	0.25	0.66	0.50
Fibre . .	16.16	4.29	7.24	8.39	10.56	2.69	7.91	3.73	7.62	6.24	8.51	10.81	8.53
Ash . .	18.47	14.95	9.53	9.77	17.42	10.10	12.73	13.03	13.25	8.09	7.78	22.95	13.94
Nitrogen-													
free extract	41.61	24.30	18.11	22.06	28.71	10.76	23.75	16.79	23.25	22.81	26.39	31.20	26.00

M. L. Y.

263 - **The Decline in the Yield of Egyptian Cotton and its Causes** (1). — DUNGEON, G. C. (lately Consulting Agriculturist to the Government of Egypt), in *Bulletin of the Imperial Institute*, Vol. XIX, No. 2, pp. 160-174. London, 1921.

In this article attention is drawn to some points which seem to have been generally overlooked, and to correct as far as possible some conclusions which appear to have been formed on insufficient grounds.

A survey is made of the existing state of affairs in Egypt as regards the cotton areas and the yields of former as well as of recent years. With regard to the depreciation in the last 7 years, so many new and unforeseen influences have affected the cotton crop that it is considered hardly possible to regard the conditions as in any way normal. The factors influencing the yield per acre are however considered to fall under 3 important headings and are discussed in the following order: —

1) DETERIORATION OF THE PRODUCTIVE POWERS OF THE SOIL IN COTTON-GROWING AREAS. — a) *Excessive cultivation*. — It is an accepted maxim among Egyptian cultivators that the correct rotation of their crops admits cotton cultivation once every three years *i. e.* only  $\frac{1}{3}$  of the cotton growing area or approximately 1 500 000 feddans (2) should bear the crop each year. On reference to the tables it may be noted that from 1905 to 1920 (with the exception of 1915 to 1918 owing to war conditions) this ideal figure had been regularly exceeded, sometimes by as much as 10 % for the whole of Egypt. Consequently the soil ingredients were drawn upon unevenly and the balance of fertility was upset. The fault lies in the fact that advantage has not generally been taken to apply the remedy when the opportunity presented itself, and the recent insuperable difficulties as regards the obtaining of manure.

One of the chief incentives to the practice of excessive cotton cultivation has been the custom of leasing land to tenants on short terms of 3 years. This has been a source of great competition among applicants, and the highest rents are paid to landowners who permit the greatest amount of cotton to be cultivated within the period of the lease. The tenant, having no interest in the land beyond the term of his tenancy, extracts all the cotton possible during that time, but does not attempt to re-establish the fertility of the land for his successor.

This deterioration caused by excessive cultivation could, however, be duly rectified, were it not that other noxious influences have been affecting the soil at the same time.

b) *Rise in the Water Table in the Delta* (3). — The years in which the cotton production was at its highest were those in which the water-supply was limited by the amount which could be carried by the deep canals, and owing to this limitation the soil drained into the canals when their flow was shut off, and in consequence, did not become sodden. After

(1) See *R.* July 1913, No. 801. (*Ed*)

(2) 1 feddan = 1.038 acres. (*Ed*)

(3) See *Movements of Soil Water in an Egyptian Cotton Field*, *R.* Dec. 1913, No. 1323. (*Ed*)

the Assouan Reservoir began to be drawn upon, much more water became available for irrigation, but the canals ran at a higher level, rendering most of the area to which water had previously to be lifted by great exertions what is termed "free-flow" *i. e.* where, by merely opening a sluice the water runs by gravity on to the land water-logged. The injurious effect on growing cotton was evident. Firstly, the use of water above the root system caused asphyxiation of the roots and produced flower and boll shedding and not infrequently premature death. Secondly, lack of adequate drainage caused a return of noxious salts and the toxic effect was obvious. (1)

The establishment of proper drainage will be gradual, and in certain cases, perhaps unnoticeable for some time, owing possibly to the formation of a condition in the soil similar to «hard-pan» for which additional expedients must be employed to restore fertility.

c) *Insufficient supply of manure and fertilisers, and the introduction of noxious substitutes* — This is largely due to the unremunerative results obtained with cattle-breeding, and the consequent shortage of farmyard manure

2) RAVAGES OF INSECT PESTS — The necessity of legislation concerning the pink bollworm (*Gelichia gossypiella*) is a matter of distinct importance (2) The measures instituted to meet the ravages of this new pest are such that, when fully in force a diminution of its numbers may be expected, and as this result implies a retarding of the period of maximum severity, the cotton plants will have a greater opportunity of maturing their late-formed bolls with less injury and of thus increasing their yields.

3) AGRARIAN DISTURBANCES — A short discussion as to the effect of political disturbance etc on the financial situation with regard to cotton

M. L. Y.

264 — Cultivation Trials of "patwa" (*Hibiscus cannabinus*) in India. — See No 227 of this Review

#### PLANTS YIELDING OILS

265 — The Cultivation and Production of the Olive Tree in Spain. — (3) MATONÀ, A. (Director of Olive cultivation in Catalonia), in *Revista olearia italiana* Year XII, Nos 9-12, pp 144-148, Rome, September-December, 1921

The author shows the progress made in olive-growing and the olive-oil industry in Spain, and emphasises the advantages that would accrue if the Spanish and Italian manufacturers could arrive at some mutual agreement regarding the improvement of the industry and the better utilisation

(1) See *Egyptian Scientific Journal*, Vol II, p 413, and Vol V, p 190, dealing with the salt-content of some agricultural drainage waters of Egypt. This shows that where a high water table and no drainage occurred there was a concentration of injurious salts in the surface soil causing it to become useless for cultivation. (Ed)

(2) See *R* April 1921, No 388 (Ed)

(3) See Prof Manuel PRIRGO's Original Article Olive Growing and Production in Spain, in *R* Dec 1916, pp 1727-1733 (Ed)



of the product. He gives the following data respecting the conditions of olive-growing in Spain.

According to the statistics of 1920-1921, the area under olive-trees is 1 571 294 hectares. It is continually extending and in 1907 the olive yards occupied only 1 353 196 hectares. Olive-growing has increased markedly of late years and owing to the high price paid for olive-oil, agriculturists have transferred their preference from the vine to the olive-tree. The methods of cultivation are not altogether perfect in Spain, but it must be allowed that they are quite as good as the average methods followed in Italy. In some regions, such as a large part of Catalonia and of Aragon, and certain districts of Andalusia, fairly systematic and successful methods are adopted.

In the South specialised olive-yards are preferred. Andalusia and Estremadura are the typical districts of the large, Spanish country estates, some of which occupy 30 000 ; 40 000 ; 50 000 and even 60 000 hectares, and it is easy to find there olive yards of several hundred hectares.

In Catalonia on the other hand, where the land is much subdivided, olive-trees are often grown in association with the almond, carob, hazel and vine, or herbaceous crops

Although some books speak of the irrigation of the olive-tree in Spain, it can fairly be stated that it is only practised in areas of very limited extent. The land capable of irrigation is naturally reserved for other more suitable crops, and the olive-trees that happen to be associated with them benefit by the water supplied.

Olive production has increased with the extension of the cultivated area, and owing to considerable improvements in the methods of cultivation in certain regions, as is shown by the appended Tables

The industry of preserving olives uses about 350 000 quintals of the fruit annually, viz : 390 197 quintals in 1914 ; 364 456 quintals in 1916 ; 477 737 quintals in 1918 ; 315 930 quintals in 1920.

The finest oil is made chiefly in Catalonia, in the part of the Province adjoining Aragon, at Toledo, and also in some districts of Andalusia. At the present time, it is true that good oil is found more or less everywhere as there are many oil-factories, but the true oil for exportation which is highly prized by the French and Italian merchants, is the Catalanian product coming from Borges, Reus and Tortosa, and also that from Alcañez (Aragon).

It must be allowed that as a rule, the manufacturing process in Spain is on the same level as in Italy, although in certain regions it is defective owing to the use of superannuated apparatus and old fashioned methods. There are however entire regions of great extent where the plant and treatment leave nothing to be desired and olive oil is produced with an acid content below 0.5 %. Of the 500 000 quintals of oil annually made on the average in Catalonia, at least  $\frac{2}{3}$  are of a fine quality suited for exportation. In this Province the fresh or recently-gathered olives are usually but little handled and the oil is extracted without the use of hot water, by being subjected twice in succession to severe pressure. Not infrequently the oil

coming from the presses is very rapidly washed in order to free it more quickly from the water of vegetation.

Of recent years, the co-operative oil-factories have greatly developed especially in Catalonia, and hence the improvement in the quality of the output. At the present time there are 30 factories in this region producing some 50 000 quintals of olive-oil. The three or four largest factories each handle some 200 quintals of olives. Their plant and methods are thoroughly up to date.

TABLE I. — *Production of Olives and Olive-oil in Spain during the Period 1908-1920.*

Years	Olives quintals	Olive-Oil quintals
1908 . . . . .	8 277 174	1 518 895
1909 . . . . .	13 928 938	2 397 720
1910 . . . . .	6 246 189	1 085 088
1911 . . . . .	22 195 164	4 217 826
1912 . . . . .	3 553 310	630 012
1913 . . . . .	14 868 745	2 654 225
1914 . . . . .	11 814 306	2 077 649
1915 . . . . .	17 728 868	3 261 079
1916 . . . . .	11 465 989	2 071 150
1917 . . . . .	22 077 001	4 278 376
1918 . . . . .	14 038 314	2 552 023
1919 . . . . .	18 130 999	3 363 937
1920 . . . . .	16623 845	3 169 637

TABLE II. — *Oil Production of the different Regions of Spain in 1920-1921.*

Areas	Oil Produced
hectares	quintals
New Castile . . . . .	111 335
Old Castile . . . . .	6 830
La Mancha and Estremadura . . . . .	175 726
Leon . . . . .	4 241
Aragon . . . . .	56 078
Navarre and Rioja . . . . .	15 734
Galicia . . . . .	214
Catalonia . . . . .	514 760
Levant (Valencia) . . . . .	118 820
East Andalusia . . . . .	367 172
West Andalusia . . . . .	500 304

The great variations between the output of oil in different years are due to the spread of diseases or of parasites. The most formidable of the latter in Spain, as elsewhere is the Olive Fly (*Dacus oleae*) Meig. As a means of control efforts are now being made to popularise the LOTRIONTE method which was widely tested in Catalonia in 1920.

F. D.

266 - Illipe Nuts of British North Borneo from *Shorea stenoptera* and other Dipterocarps. — *Bulletin of the Imperial Institute* Vol XIX, No 2, pp 140-142. London, 1921.

The "illipi" nuts of British North Borneo are quite distinct from those of India which are obtained from species of *Bassia* (Nat. Order. Sapotaceae). A full account of the different forms of the Borneo nuts derived from various dipterocarp trees, with the results of examination at the Imperial Institute is given in a previous publication (*Bulletin of the Imperial Institute*, Vol. 13, No. 3, pp. 335, 1915). Since then a quantity of kernels have been forwarded recently for investigation and the results are here given. The kernels were stated to have been obtained from nuts collected in the Kinabatangan district and washed in sea water.

The kernels were found to contain 6.9 % moisture, and to yield, on extraction with light petroleum, 44.8 % of fat, corresponding to a yield of 48.1 % from the moisture free kernels. The fat was a greenish-yellow solid with a faint odour and on examination gave the following results:— specific gravity at 15° C, 0.8551; refractive index at 40° C, 1.456; solidifying point of fatty acids, 52.5° C; melting point of fat 34° C, acid value 11.4; saponification value (mgm. of potash per 1 gm. oil) 192.4; iodine value % 32.2, unsaponifiable matter % 0.6; volatile acids, soluble 0.1 and insoluble 0.4 cc. of decinormal alkali required to neutralise acid from 5 gm. of oil. A comparison is made with the results obtained with a previous sample of illipe fat and with figures previously recorded for Borneo tallow.

The residual meal left after the extraction of the fat from the kernels was yellowish brown and had a faint bitter taste. The results of analysis are as follows: % moisture 11.9, crude proteins 10.3, fat 7.8, carbohydrates etc (by difference) 64.5, crude fibre 3.2, ash 3.3, nutrient value 1: 8.0 and food units 110. (A comparison is given of figures recorded previously for illipe cake").

The meal contained no alkaloids or cyanogenetic glucosides.

These kernels represented the brown variety and contained 48 % of fat in the dry material, which is about the usual yield.

It is stated that in spite of the somewhat low percentage of protein (11.3 %) in the residual meal which renders it a less valuable foodstuff than palm-kernel cake (16 %), the illipe meal has already proved its value commercially.

M. L. Y.

267 - The Value of the Oil of the Physic or Purging Nut (*Jatropha Curcas*) and Utilisation of the Residual Cake as Manure. — *Bulletin of the Imperial Institute*, Vol XIX, No 3, pp 288-291 London, 1921.

The evergreen shrub *Jatropha Curcas* Linn. (N. O. Euphorbiaceae) is indigenous to South America but has been introduced into most tropical countries. Apart from the purgative and emetic properties of the oil obtained from the seeds and its utilisation for soap manufacture (a fact proved at Lisbon on receipt of seeds from Portuguese Africa), suggestions have also been made as to its possible value as a lubricant to replace castor oil.

Seeds from South Africa and the Gold Coast were examined at the Im-

perial Institute, London, and consisted respectively of shell 39 and 33 %, kernel 61 and 67 %, moisture in seed 7.9 and 11.1 %, yield of oil 31.9 and 33 % and yield of oil expressed on dry seed, 34.6 and 37 %.

An analytical comparison is made between these oils and oil from Nigerian seed examined previously (*Bulletin of the Imperial Institute*, 1904, Vol. 2, p. 170).

To test the value of curcas oil as a lubricant, viscosity tests were carried out with the oil samples and an interesting comparison is made with a commercial sample of castor oil as follows (viscosity in seconds for 50 cc. at 70° F): Gold Coast sample 1; 298; sample 2; 290; South Africa 284, castor oil 3888.

All these samples were also exposed in thin films on glass under varying conditions and according to the results obtained, it is evident that curcas oil differs widely in viscosity and drying properties from castor oil and dried more rapidly when exposed to high temperature and to light and air. For certain types of machinery therefore for which castor oil is particularly suited as a lubricator, curcas oil could not be used with advantage.

Examination of the residual oil cake sent from Zanzibar, prepared from undecorticated seed proved on analysis that the cake has a high value as a manure, being approximately as rich as castor-seed cake in nitrogen and phosphoric acid. It is suggested that the ash obtained on burning the cake would form a valuable concentrated manure, or the potash might be extracted and utilised locally for soap-making. The following percentage composition was determined: moisture 10.4, nitrogen 3.2, phosphoric acid 1.4, potash 1.2, soda 0.21, chlorine 0.13, sulphuric acid 0.08, ash 5.6. The ash contained: phosphoric acid 25.7, potash 20.7, soda 3.8, chlorine 2.4, sulphuric acid 1.5.

In consideration of the fact that the residual cake or meal has purgative properties and could not be utilised as a feeding stuff, but only as a manure, it would doubtless realise a relatively low price. M. L. Y.

268 - **Economic Value of the Seeds of *Carthamus* spp. and their Oil Product.** - See No. 227 of this *Review*

#### DYES

269 - **Observations on the Cultivation of Java Indigo at Pusa, India.** - See No. 227 of this *Review*.

#### SUGAR CROPS

270 - **The Qualities of Java Seedling Sugar Canes and suggested Introduction into Louisiana U. S. A.** - CROSS, W. E., *Revista Industrial y Agrícola de Tucuman*, Vol. XI, Nos. 9-10, pp. 118-121, Buenos Ayres, 1921, and in *International Sugar Journal*, Vol. XXIII, No. 265, pp. 614-616 London, Nov. 1921.

The seedling varieties under discussion were produced in Java by crossing the Cheribon cane with the variety Chunnee which grows freely in northern India under generally adverse conditions. These hybrids POJ 36 and POJ 213, combine the qualities of the two parents, being rich in sugar like the Cheribon and very vigorous and highly resistant to disease and frost damage like the Chunnee. For sub-tropical conditions, they are among the best varieties at present known.

It has been noted that although Louisiana U. S. possesses more favourable conditions for cane cultivation than Tucumán (Argentina), only one-year ratoon crop is obtained and it is necessary to practise a rigorous system of rotation, ploughing under leguminous crops one year in every three. In addition to this, considerable quantities of commercial fertilisers have to be applied. — Tucumán on the other hand obtains ratoon crops up to 6 or 8 years, gives little or no attention to the question of crop rotation, uses no fertilisers and obtains with the Java seedling canes better yields of cane and sugar than is generally the case in Louisiana. It is therefore recommended that Louisiana planters might introduce and study these seedlings to their commercial advantage. A summary is given of the qualities of the two Java seedlings P(1) 36 and 213 as follows: —

1) Vigorous varieties of great ratooning power, giving heavy yields. The limiting factor in Tucuman is the low annual rainfall; in Louisiana this limiting factor disappears.

2) Low cost of cultivation, as they grow very rapidly in spring, Louisiana has the advantage of earlier spring rains than Tucuman, hence early development would be much more marked.

3) Very resistant to the cane borer (*Diatraea saccharalis*). As a point of comparison it may be noted that this was a very serious pest of the Cheribon cane.

4) Much more resistant to frost damage than the Cheribon and the D74, and would probably enable the harvest period to be deferred to a later date, thus eliminating the disastrous effects produced on the stubbles by early cutting and enabling the factories to obtain riper cane for grinding purposes than at present

5) More resistant to root disease (*Marasmius Sacchari*) and mosaic.

6) Greater resistance to the rotting of the stubbles during the winter. The advantage of introducing these seedlings into a country where the winters are moist *e. g.* Louisiana is therefore evident, seeing that the cane from the first year's stubble has up till now been less than the plant cane, and the second year's stubble has given so small a yield as not to be worth cultivating.

7) Much more fibrous than the Cheribon, containing an average of 12.5 % fibre compared with 10.0 or 10.5 % for the latter. This allows for a higher sucrose extraction from the same mill and diminishes the cost for fuel.

M. I. Y.

271 - **Tests of New Methods of Propagating the Sugar-Cane in Cuba.** — CAI VINO, M., in *Revista de Agricultura, Comercio y Trabajo*, Year IV, pp 500-503, figs 2 Havana, 1921

At the Agricultural Station of Cuba the author has tested the method of propagating sugar-cane which was recommended for India, by KULKARNI (1). This consists of cutting the cane into setts of 3 nodes (taking them from a little above the two last nodes), and of removing all the eye-buds, except the one of the middle node. The sett should be planted, so that the eye-

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(1) See R. March 1920, No 327 (14)

bud points upwards; in this way a much more vigorous tuft of sugar-canes is obtained than if the eye-bud pointed downwards.

The results were perfectly satisfactory, as is seen from the following comparative data.

*Yield in kg. per Hectare.*

Variety	Sett with one eye-bud	Sett with all its eye-buds
D 74 . . . . .	68 690	63 790
D 99 . . . . .	71 150	61 330
D 108 . . . . .	24 529	23 310
Uba . . . . .	82 800	75 440
Cristalina . . . . .	46 000	36 800

This system can be improved by adopting the practice (devised in Cuba by ABREN and recommended for India by VENKATRAMAN) of letting the setts bud before planting them out, thus giving an opportunity for choosing the most vigorous shoots.

A frame of bamboo is erected at a convenient height above the ground, say 90 cm., and upon it is spread a thin layer of straw which is soaked with dung mixed with a little water. The setts are first dipped in a mixture of dung and water and then piled up roughly on the frame, so that they form heaps, the setts crossing each other in every direction, thus allowing free access to the air. The small heaps are in their turn covered with a layer of straw soaked as before in a mixture of dung, the whole being kept moist by repeated and careful watering.

The increased yield fully compensates for the larger number of workers required. Sometimes, however, lack of labour makes it impossible for the process to be carried out on a large scale, in which case only the cuttings destined for the plantations reserved for propagation can be thus treated.

F. D.

## LIVE STOCK AND BREEDING.

HYGIENE

### 272 — *Helenium Hoopesii*, a Poisonous Plant harmful to Stock in Utah, U. S. —

MARSH, D. W (Physiologist in Charge of Investigations of Stock Poisoning by Plants) CLAWSON, A. B., (Physiologist), COUCH, J. F. (Pharmacological Chemist), and MARSH H., (Veterinary Inspector, Bureau of Animal Industry), in *United States Department of Agriculture, Bulletin No. 947*, pp. 1-46 tables 13, bibliography of 13 works. Washington, D. C., Oct. 11, 1921.

The "western sneezeweed" (*Helenium [Dugaldia] Hoopesii*) has become very abundant on some of the more elevated and overgrazed stock ranges of the western United States, especially in Utah. It is found in the yellow pine belt, grows also in the aspen and spruce belts and sometimes reaches the arctic alpine zone.

Feeding experiments carried on at the Salina Experiment Station in Utah with sheep and cattle showed that this plant was the cause of the so-called "spewing sickness" of sheep, and cattle also to a certain extent suffered from poisoning.

The symptoms produced by the plant, the pathology and the toxic dosage were all studied in detail. The poisonous principle is an easily decomposed glucoside ("dugaldin") which proves toxic when received orally, intravenously, subcutaneously or by the rectum.

The most marked symptoms are general depression, weak pulse, nausea followed or not by more or less chronic vomiting. Death is not accompanied by convulsions.

No effective medicinal remedy has so far been found. As to the possibility of exterminating the plant, experiments in scythe cutting proved of no avail and experiments are in progress to test the effect produced by restriction of grazing and allowing the range to reseed itself and also as to the possible extirpation of *H. hoopesii* owing to the growth of grasses and weeds.

M. L. Y.

273 - **Use of Stomosines in the Treatment of Infectious Diseases of Live Stock.** — CENTANNI, E., in *L'Italia Agricola*, Year 56, No 12, pp 366-368 Piansance, December 15, 1921.

Stomosines are immunising substances discovered by the author which differ from those hitherto known (serums and vaccines). The latter have a preventive and the former a curative effect; they contain in an innocuous form the principle that destroys the micro-organisms and their poisons.

When the preparation of serums was extended to all infectious diseases, insurmountable difficulties were experienced owing to the different kinds of poisons produced by bacteria and the various ways of neutralising them.

Bacteria are the cause of two distinct sorts of poison, true specific toxins and aspecific endotoxins. The first are the product of a very small number of the least common bacteria consisting almost exclusively of the pathogenetic agents of tetanus and diphtheria; in the case of all the others, the fundamental poison causing the complex of the symptoms is an endotoxin. Since it is impossible to make immunising serums against endotoxins, it may fairly be said that a serotherapeutic has found itself disarmed in the face of most infectious diseases and is unable to intervene with any prospect of success when once the syndrome has declared itself.

In trying to discover what defensive means the organism adopts during the course of the disease, in order to free itself from these poisons and regain health, the author found that the active agent is a ferment or rather a kinase, increasing the activity of the ferments and so constituted that the endotoxins are attacked and burnt, being thus quickly reduced to inoffensive substances.

The author has given the name of "stomosine" to this kinase, which he prepared and isolated by means of chemical processes, taking as his point of departure the protein-bacterial principles arising from the micro-organisms inducing the disease.

The poisons disseminated by the bacteria installed in the organism have two ways of manifesting themselves. Those carried by the blood produce the syndrome of fever and all the local troubles accompanying it (abscesses, sores, ulcers etc.), while the others cause the complex of symptoms resulting in the irritation and inflammation of the tissues surrounding the centre of infection. As is required by this double symptomatology, the action of the stomosines is also twofold, being both general and local.

Shortly after infection, which is followed by violent shivering, a rise of temperature takes place (average  $1^{\circ}$  to  $1.5^{\circ}\text{C}$ ) showing that the combustion of the infected matters has begun. The temperature remains at this level for 8-10 hours and then suddenly falls (the change being accompanied by profuse sweating) to normal, or nearly normal. If the effect is complete, a single injection is enough to produce a cure. Sometimes, however, it is necessary to repeat the operation two or three times to obtain definitive results. In some of the most resistant cases, the disease becomes of a benign character.

The effect upon the local centre is similarly explained: the irritant poisons are destroyed and therefore all the symptoms of inflammation (congestion, exudations, pain), are removed, the surface becomes healthy and cicatrization rapidly takes place.

So far stomosines have been prepared for the chief infectious diseases of cattle (epizootic foot-and-mouth disease, diarrhoea in calves, polyarthritis and septic pneumonia); of pigs (swine fever, septicaemia, paratyphus and measles); of horses (equine adenitis, colt polyarthritis) and of poultry (fowl cholera and avian pest).

Even where the pathogenetic agent is an invisible virus that cannot be cultivated, the effect of the stomosine is satisfactory, probably because also under such a form the actual toxic factor is an intermediate poison of the nature of an endotoxin. This is the case with the virus of epizootic foot-and-mouth disease, swine fever and avian pest; all these diseases and especially swine fever, have proved amenable to stomosine treatment.

Stomosines are agents of an essentially curative character; as soon as they are introduced into the organism, they find themselves in the presence of poisons and bacteria which they attack and render powerless as described above. If, as in the case of preventive infection in a healthy organism, they encounter no pathological element, they remain in the circulatory system, but their power decreases somewhat rapidly in the course of a few days.

Their true use is to effect a cure, and they act even if introduced when the disease is in full development, or actually far advanced, but to obtain a more certain result, they should be employed as soon as the malady first declares itself. If an outbreak of epizootic disease occurs in a stable, not only the first animal attacked should be treated but also all the animals that have been in contact with it, in order to interrupt the incubation of the disease or prevent its occurrence.

Should the disease have made its appearance in the neighbouring stables, a general preventive treatment must at once be begun in all the



threatened stables without waiting for it to assume an epidemic form. In order to prolong the protection, seeing that the immunisation is not of very long duration, the injection ought to be repeated on an average every fortnight, as long as any danger threatens; in this way the owner may be sure that his stock will entirely escape infection or that the disease will assume a benign form in any of the animals attacked.

Stomosine is supplied in two forms: a) liquid for immediate use, b) as a soluble sterilised powder for keeping a long time. The average dose is from 5 to 10 cc. per quintal of weight. The most effective way of using it is in the form of an intravenous injection; this induces the largest number of instantaneous crises and should be adopted for very urgent cases. In ordinary cases since the liquid diffuses very readily, a subcutaneous injection is all that is required. The injection has never produced bad effects, for the substance of which it is composed is an elective kinase without any toxic or anaphylactic action.

F. D.

- 274 - **Protozoan Parasites of Domestic Animals in Transcaucasia.** — JAKIMOFF, W. L., in *Bulletin de la Société de Pathologie exotique*, Vol. XIV, No. 10, p. 652. Paris, December 14, 1921.

In the Chemical and Bacteriological Laboratory of the Malaria-epidemic Mission of the Union of the Russian Zemstvos (which has its Headquarters at Prokhladnoe near Kars), the author and his collaborators found the following protozoan parasites: in cattle, *Piroplasma bigeminum* (peripheral blood); *Sarcocystis blanchardi* (peripheral blood and blood of heart); *Trypanosoma theileri*; in camels from the Government of Sakaspiisk, the author's colleagues, the veterinary surgeon, JILINI and Dr. SOULINA SAMAILLO found *Trypanosoma Ninae Kohl-Jakimoff* which the author had already met with in 1913, in the camels of Turkestan (1).

No microfilariæ, or endoglobular parasites were discovered either in the horses or dogs.

F. D.

- 275 - **Researches on the Mite-Destroying Power of some Substances used against Parasitic Mange in Horses.** HENRY, A., in *Recueil de Médecine vétérinaire*, Vol. XCVII, No. 18, pp. 355-370. Paris, September 1921.

In order to test the various substances used as remedies against parasitic horse-mange the author made use of the methods most commonly employed which consists in placing the parasite (sarcoptes or psoroptes) in contact with the substance and observing under the microscope how soon the insect dies, or rather how long it can live, its resistance being proportionate to the activity of the acaricide. As a counter-test (to determine if death is real or only apparent and a reflex protective device,

(1) In Russia in Europe (Government of Astrakhan), the trypanosomes of the camel were found in 1912 and in Russian Turkestan and the Ural in 1913 and 1914 respectively. W. L. JAKIMOFF and Mlle W. J. WASSILIEVSKY (*Bulletin de la Société de Pathologie exotique*, Vol. XIV, No. 10, pp. 637-640) have established the identity of the Turkestan and Ural trypanosomes. The researches made by MICHIL at JAKIMOFF'S request, have proved that these trypanosomes differ from those of "surta" (*Trypanosoma evansi*), and of "debab" (*Trypanosoma sudanensis*).



as the author express it), the dead or apparently dead mites are put into peanut oil at 30-32° C, an artificial medium considered the most suitable by the author, seeing that the parasites are able to live in it for several days without any inhibition of some of their functions. The author defines the unit of acaricide power as the capacity for killing psoric mites in 5 minutes at the temperature of 30-32° C. Thus, beech creosote which kills the mites in 2 minutes, has an acaricide power of 2.5; pea-nut oil dissolving sulphurous acid in the proportion of 1% (by weight), has an acaricide power equal to unity, because it kills the psoric mites in 5 minutes at 30-32° C; and a 2% aqueous emulsion of cresyl destroying the mites in 10 minutes has an acaricide power of 0.50.

The other substances tested gave the results set out in the following Table. The author draws from them the following conclusions which are of practical importance

1) Sulphurous acid dissolved in oil proves to be the most effective acaricide (it is not necessary to increase the saturation beyond 2.5%; as this does not make the activity greater)

2) A 1 or 2% warm or tepid, aqueous emulsion of cresyl is the most energetic anti-acarian disinfectant. F D

276 - **A New Disease of Oxen: Contagious Acute Encephalitis.** — DONALD N. A. and BOSSHUIS, R., in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 1, pp. 250-252 Paris, January 23, 1922.

The authors report a contagious disease that during the autumn of 1921 carried off 9 of the oxen in a herd belonging to a farm near Algiers. The symptoms of the disease were signs of madness and abundant salivation; there were no actual lesions.

Experimental research showed, that it was a contagious complaint transmissible in series to the ox, rabbit and guinea-pig. It is due to a new neurotropic virus which should probably be placed in the same category as the human diseases, encephalitis lethargica and acute anterior poliomyelitis. F D

277 - **Vaccination of Cattle against Rinderpest.** - NICOLAS, E. and RIVARD, P., in *Comptes rendus de l'Académie des Sciences*, Vol. 173, No. 25, pp. 1428-1429 Paris, December 10, 1921.

The countries where rinderpest has become endemic (Eastern Europe, Asia and Africa) cattle are inoculated against this fatal malady according to KOLLE and TURNER's method which has now become universal. This method consists of infecting, at the same time and into two different places, a small quantity of virulent blood, 0.2 cc., to 1 c.c., or more (taken from an animal suffering from rinderpest, and at the height of the fever-period), and also anti-rinderpest serum in proportions varying according to the activity of the serum and to the size of the animal to be vaccinated. The amount must however be sufficient to insure that this double simultaneous infection, which is a real sero-infection, shall be followed by a "good reaction", that is to say one that after a short incubation period, lasting usually 3 to 5 days, results only in a rise of temperature that may regis-

ter as much as 41° C and is quite compatible with a satisfactory condition of health, for no lesions of the mucous membranes are developed although a slight degree of lachrymosis is frequently present. After, such a reaction the animals are as effectively and durably immunised as if they had recovered from the disease.

When well carried out this method gives excellent results, fatal effects being most rare ; it has, however, one serious drawback, that of producing in the inoculated animal a reaction that not only has the appearance of rinderpest, but is actually due to an attenuated form of the disease. Hence the vaccinated individual becomes a source of infection to healthy animals capable of contracting the malady, so that if care is not taken this method increases the sources of virus and becomes a means of spreading and perpetuating rinderpest.

This evil can be remedied by vaccinating in zones, but it is possible greatly to lessen, and perhaps, cause it to disappear, by increasing the amount of serum injected, so as to effect a "silent" vaccination. This seems to be proved by the results of experiments observed by the authors during the course of the Mission to Belgium with which they were entrusted during the epidemic of 1920.

They certainly found on various occasions, that by using the right doses of serum of which the effect has been ascertained by comparison with that of a known virus, it is possible to avoid producing any external symptoms that can be detected by the examination of the patients. Vaccination was however attained, as was shown by the fact that the test experiment with pure virus had no effect, any more than the subsequent injections of large quantities of virulent blood which were made with a view to hyper-immunisation.

This being the case it is probable that active vaccination, "silent" in so far that it produces no apparent reaction on new subjects, cannot create a dangerous centre of infection in the zone where it is carried out. This form of vaccination will therefore be the one most usually adopted.

F. D.

278 - **Summary of Experiments on Foot-and-Mouth Disease (1) in France.** - ROUX, E., VALLEE, H., CARRÉ, H. and NOCARD (the late). in *Comptes rendus de l'Académie des Sciences*, Vol 173, No 23, pp 1141-1145 Paris, December 5, 1921

At the request of the French Government, the authors have been making researches on foot-and-mouth disease. Their work, which was begun in 1901, was only interrupted during the period of the War.

In the paper analysed they give a summary of the results of their investigations.

Like LÖFFLER and FROSCH they used young pigs (as being susceptible animals) for preserving the aphthous virus by means of successive transmissions. Between each transmission, the virus is kept in a refrigerator

(1) For other studies on epizootic foot-and-mouth disease, see R. 1911, Nos. 890, 2197, 2783 ; R. 1917, No. 954 ; R. 1916, Nos. 601 and 768 ; R. 1919, No 923 ; R. 1920, Nos. 335, and 882 ; R. 1921, Nos 309, 731, 735, 829 and 1019. (Ed.)

at temperatures below 0° C. This method has the defect of only providing limited supplies of virus.

The lymph from the vesicles and the serous liquid retain their virulence intact for no more than 3 weeks in the refrigerator; further, the lymph is bacteriologically impure.

As a source of virus, blood taken from infected heifers during the time their temperature is rising is far preferable. The authors use no anti-coagulants in their technique, substituting for them mechanical defibrination. The preservation of the virulence of the defibrinated blood is practically insured for 2 to 3 months if the blood is kept at temperatures varying from -10° C to +20° C.

The accidental introduction of extraneous matter seems to have no effect upon the keeping-qualities of the virus; it is however injured by dilution.

Pounded fragments of the desquamated epithelium and lymph from the vesicles are infectious after dilution to 1/20 000. The issues from the pericardium retain their virulence to 1/1000, whereas blood serum ceases its regular pathogenetic action, if inoculated in amounts of less than 0.2 cc.

It is a mistake as has been found by the authors, to regard aphthic virus as easily destroyed. Desiccation for instance does not exercise the deleterious effect that was supposed.

With the exception of intradermic and intramuscular inoculation, which (especially when substances containing foreign matter difficult of absorption are employed) are very severe methods of introducing the virus, and also of the frequently dangerous process of intra-venous inoculation, all the experimental methods of aphthic infection are incomparably less severe than the forms of natural contagion.

Already over 30 years ago, NOSOTTI (*Clinica veterinaria*, 1885, p. 101) considered the question of immunisation by the sub-cutaneous inoculation of virulent lymph.

The author studied the question from the beginning of their researches, and the results of their investigations as to the most favourable conditions for the re-absorption of the aphthic virus led them to use for subcutaneous infection clear, virulent, blood-serum that had been fixed by remaining 1 month in the refrigerator. The dose to be injected beneath the skin must not be less than 1 cc. Larger amounts are sometimes troublesome. If carried out properly, experimentally induced foot-and-mouth disease only causes the development of the malady in the mouth-cavity.

Artificial anti-aphthic immunity is not lasting, and disappears in less than 6 months, even in hyper-vaccinated animals. This gives little hope that the problem of anti-aphthic immunisation will ever be completely solved.

F. D.

279 - **Intestinal Coccidiosis of the Pig.**—CAUCHEMEZ, L., in *Bulletin de la Société de Pathologie exotique*, Vol. XIV, No. 10, pp. 645-648, fig. 1. Paris, December 14, 1921.

From researches at the Laboratory of Parasitology of the Faculty of Medicine in Paris and at the Laboratory of the Vaugirard Abattoir,

the author has discovered that intestinal coccidiosis is a disease of very frequent occurrence in swine, 26 % of the animals examined being found to be affected. The disease assumes a mild form in adult pigs causing no disturbances or lesions. Its presence may, however, serve to explain serious intestinal affections in quite young pigs. If the latter are attacked by a mild form of coccidiosis, they soon recover and have been rendered immune to the malady. There is but little literature on the subject, and in the absence of all experiments of reciprocal immunity, it is impossible to say whether the coccidiosis of cattle and swine is identical. The author proposes the provisional name of *Eimeria brumpti* for the pathogenic agent in swine coccidiosis. It differs from the 3 species of parasite attacking man and identified by C. DOBELL as belonging to the genus *Eimeria* and there is therefore no reason to suppose that swine coccidiosis can be transmitted to human beings.

F. D.

# FEEDS AND FEEDING

280 - **Experimental Studies on the Systematic Use of Food for Cattle in the United States.** -- I. TROWBRIDGE, P. F., MOULTON, C. R., and HAIGH, I. D., in *University of Missouri, College of Agriculture, Agricultural Experiment Station, Research Bulletin* 28, pp. 129, tables 55, figs. 26, Columbia, Missouri, 1918. -- II. TROWBRIDGE, P. F., MOULTON, C. R., HAIGH, I. D., *Ibidem, Research Bulletin*, No. 30, pp. 106, tables 68, figs. 25, 1919. -- III. HAIGH, I. D., MOULTON, C. R. and TROWBRIDGE, P. F., *Ibidem, Research Bulletin*, No. 38, pp. 47, tables 45, 1 plate, 1920. -- IV. ECKLES, C. H. *Ibidem, Research Bulletin*, No. 36, pp. 20, tables 7, figs. 5, 1920. -- V. MOULTON, C. R., TROWBRIDGE, P. F., and HAIGH, I. D., *Ibidem, Research Bulletin*, No. 43, pp. 111, tables 57, figs. 30, 1921.

I. — EFFECT OF LIMITED FOOD ON GROWTH OF BEEF ANIMALS. — The objects of these experiments were to determine: 1) if an immature animal can use its stored fat to protect growth when sparsely nourished and to what extent the body fat may be relied upon to insure the continuation of growth; 2) the changes that occur in the composition of the bodies of immature animals when kept for a considerable time on a so-called maintenance ration, and also the changes that take place when such animals are kept on a ration above maintenance, but insufficient to supply the maximum growth of which the animal is capable. This work is of practical importance for it is a common habit among many farmers to bring young cattle through the winter with practically no gain in weight, so that these animals make a very marked skeletal growth and become very thin.

In October 1907, a number of closely related steer calves that had been dropped early in the preceding spring were taken and put on a liberal feed. Seven thrifty yearling animals were later selected from among them, and 6 were given the experiment rations, 3 for 6 months and 3 for 12 months, they were afterwards slaughtered and analysed. The 7th was slaughtered and analysed at the outset of the experiment and used as a check animal, the composition of its body being taken as representative of that of the other animals at the beginning of the experiment. Of the remaining steers (Nos. 593 and 599), the fattest and thriftiest, were fed so as to gain  $\frac{1}{2}$  lb. per head per day; Nos. 597 and 595 received a ration producing no

change in their weight, and the thinnest pair (Nos. 591 and 592), were fed to lose  $\frac{1}{2}$  lb. per head per day.

At the beginning of the experiment (February 25, 1908) the calves were from 9 to 12 months old. The same ration was supplied to all the animals, the only variation being in quantity. The grain (maize chop 8 parts, linseed meal 1 part) was fed twice daily in equal amounts, the hay was fed at night only and was  $\frac{4}{10}$  as much as the daily grain ration. One animal of each group (Nos. 591, 597 and 593), was slaughtered on September 1. In November a digestion trial was made with the remaining animals. The results are given in Table I.

TABLE 1. — *Coefficients of Digestibility for Steers on different Planes of Nutrition.*

	Super Maintenance	Maintenance	Sub Maintenance
Protein . . . . .	69.614	66.644	61.574
Fat . . . . .	83.781	84.042	81.043
Crude fibres . . . . .	43.296	29.117	30.048
N-free extract . . . . .	85.478	82.485	79.699
Total nutrients . . . . .	77.521	73.374	70.559

The figures show that the condition of the animal has a great influence upon its digestive capacity; a very meagre ration diminishes the coefficient of digestibility.

When a fat yearling steer is kept at body weight maintenance for one year, his maintenance cost in nutrients per thousand pounds of live weight is only slightly less during the first 6 monthly period than the second. During the first period the impetus to grow causes the addition of flesh and bone. Fat must be consumed to maintain constant weight, thus supplementing the ration. During the second period, the impetus to grow is less, there is more active tissue to maintain and less available fat; hence the increased demand for food to maintain body weight.

During the first 188 days of the experiment, Steer No. 595 consumed in nutrients 8.06 lb. per day per thousand pounds, during the second period 8.20 lb.

As regards the 2 steers fed the submaintenance ration, during the first 188 days, one pound loss in weight effected a saving of 1.9 lb. of nutrients for No. 591 and of 2.8 lbs. for No. 592. During the second period (139 days), the loss of 1 lb. in weight effected a saving of 4.5 lb. of organic nutrients. For the total period of 329 days, 3.7 lb. of organic nutrients were saved by each pound of weight lost.

In the case of the 2 steers given the supermaintenance ration, during the first 188 days, per 1 lb. gain in live-weight required (in addition to the maintenance ratio), an extra consumption of 2.6 lb of organic nutrients by steer No. 593, and of 3.6 pounds by steer No. 599. For the

second period, the cost was 2.0 lb. and the average for the 362 days 3.0 lb. In the growing animal the cost of gain above the calculated maintenance ration appears to decrease during the second year of the animal's life.

Every month, 32 measurements were taken of each animal, in order to follow the changes in the skeleton. In this way the exact contour at the heart, paunch and flank girths was obtained. A chain of aluminium links, each one adjustable by means of a set screw, was used for measuring. It was found that the growth in height and length was not affected by the insufficiency of the ration. Later, the sub-maintenance animals stopped growing.

As the sub-maintenance animals lose weight, there is loss in amount of blood, but when the loss of weight is very great, the loss of blood is not proportionate to the loss of weight. With the maintenance and super-maintenance animals the ratio of hide to animal increased; with the sub-maintenance steers the hide apparently lost weight as did also the heart, liver, spleen and pancreas.

The authors give in their tables accurate data showing: the food consumed during each 10 days' period, the chemical composition of the food; the live-weight for each ten-days period; the body measurements (taken every month); the weight and composition of each organ and of the different parts of the body when the animal was slaughtered.

A summary of some of the most important data for the solution of the problems the authors had in mind are given in Table II.

TABLE II. — *Changes in the Chemical Composition of Steers over One Year of Age on Different Planes of Nutrition.*

No. of animal	Average daily change in live-weight	Duration of feeding period	Whole animal			Adipose texture		Lean Flesh		Skeleton		
			Moisture	Fat	Protein	Moisture	Fat	Moisture	Fat	Moisture	Fat	Ash
	gm.	Days	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.
592 . . . . .	- 270	327	- 26.4	- 44.3	- 10.9	- 5.1	- 27.9	- 27.3	- 8.1	- 10.3	- 4.9	+ 0.55
591 . . . . .	- 200	188	- 16.4	- 25.1	- 3.9	- 1.0	- 19.2	- 12.8	- 5.6	- 1.1	- 1.6	+ 0.21
595 . . . . .	- 9	362	+ 10.3	- 20.5	+ 1.8	- 0.5	- 17.6	+ 7.5	- 3.5	+ 1.6	+ 1.6	+ 2.04
597 . . . . .	+ 32	188	- 1.6	- 1.3	+ 0.1	- 2.7	- 2.1	- 5.6	- 2.2	+ 0.2	+ 2.9	+ 0.39
593 . . . . .	+ 240	188	+ 13.5	+ 10.5	+ 3.1	+ 1.9	+ 6.8	+ 6.9	+ 0.5	+ 1.4	+ 2.2	+ 1.53

The authors draw from these data the following conclusion: when large amounts of fat are used by the animal as a source of energy to supplement a limited food supply, some of this fat is replaced by water.

The skeleton continues growing even under feed restrictions; its growth consists in an increase in protein and fat, as well as in mineral constituents.

When young beef animals in good condition are put on a ration insufficient to provide for normal growth, there is a very persistent tendency to grow in spite of feed restrictions. Much of the surplus fat will be used for



energy, and growth of both lean flesh and skeleton will continue. Later with continued food restrictions the animals will draw on both the residual fat supply of the soft parts and also on the protein of these parts to maintain existence and promote a normal growth of the skeleton which even includes the storing of fat in the latter. As the fat supply of the soft parts becomes more seriously depleted and much of the protein of the soft parts is used to preserve existence, the animal is able to make use of the fat supply of the skeleton until it is almost entirely exhausted.

II. — COMPOSITION OF THE BEEF ANIMAL AND ENERGY COST OF FATTENING. — The objects of this investigation are to determine 1) the chemical composition of the gain made by steers in the process of being fattened; 2) the changes that take place in the form of the animal when it passes from the maintenance ration to the fattening ration, 3) the moment when the steer is just fat enough for all rational demands of the consumer, and how far this condition differs from that required by the market.

The principle results bearing on the first question have already been given by MOULTON in a preceding paper (1), in the work analysed, in addition to the data concerning the 3 steers (Nos. 18, 124, and 48), (which are chiefly used for the solution of the first question) are included those referring to 4 other steers of the maintenance group. Tables are given showing the amount of nutrients consumed by steers Nos 121 and 48 and two others during the full period which succeeded the maintenance period; the weight of the carcasses and offal of each of the 7 animals the chemical composition of the organs and of the different cuts of steers No 18, 121, 48 and of 1 of 4 other steers

In order to study the changes in the form of the animals, a number of measurements were taken at short intervals, the exact contour of the animal being taken at heart, paunch and flank either by a chain of aluminium links adjustable at each joint by means of set-screws or else by a hinged wheel with adjustable blunt prongs. The latter apparatus was devised by F. G. KING and J. M. EVVARD.

From the total results obtained it may be gathered that when steer No 121 passed from the thin condition of steer No. 18 to the average fat condition at which it was slaughtered, the lean flesh of the carcass increased 54 % and the soluble fat 284 %, while the whole carcass increased 76 %. The production of this amount of fat was in no sense waste, for it would all have been eaten by persons appreciating good meat. On the other hand the fat, lean flesh and carcass gains of No. 48 (the highly fattened animal), over the steer brought to the average fat condition were respectively 122 %, 20 % and 47 %. The fat in the highly fattened animal was too plentiful for the tastes of normal persons and therefore the energy employed in producing it was wasted.

III. — COMPOSITION OF CATTLE AT BIRTH (2). — For these researches

(1) See R. April 1918, No 411 (Ed)

(2) The *Research Bulletin* No 35 of the University of Missouri Agricultural Station deals with the Birth Weight of Calves. This work has been summarised from another source in R July 1919, No 944 (Ed)

7 aborted fetus or still-born Jersey calves and 13 Hereford calves slaughtered soon after birth were used.

The mothers were fed during gestation a grain ration of 6 parts of maize + 3 parts of bran + 1 part of linseed with roughage consisting of 3 parts of lucerne hay and 2 parts oat-straw. The cows and their calves were divided into 3 groups according to their rations of concentrates viz., high (which caused the cows to become fat during gestation); average (which kept them in good condition without fattening); low (this kept the cows in the condition of cattle on a southwest range under arid conditions. All the animals received as much roughage as they could eat

The authors obtained the following data which they arranged in Tables: — weight of blood; of the hair and hide; of the meat (fat and lean); of the skeleton; of the most important internal organs; of the excreta and of the kidney fat: the chemical composition of the blood, liver, nervous system, organs taken together, the hair and hide, skeleton, meat, marrow, kidney fat, contents of intestine, entire animal. The averages of the analyses of the whole animal, the flesh (fat and lean), and of the skeleton are summarised in Table III.

TABLE III. — *Percentage Composition of New-born Hereford Calves and Still-born Jersey Calves.*

Race and feeding of the pregnant cows	Entire Calf					Meat				Skeleton				
	Water	Fat	Nitrogen	Ash	Phosphorus	Water	Fat	Nitrogen	Ash	Water	Fat	Nitrogen	Ash	Phosphorus
<i>Hereford:</i>														
Abundant . . . . .	72.4	4.15	3.00	1.15	0.805	76.3	4.41	2.79	0.984	64.3	3.97	2.88	12.81	2.60
Average . . . . .	72.5	3.57	2.97	1.51	0.809	76.5	4.07	2.77	0.988	65.0	3.36	2.85	13.18	2.51
Insufficient . . . .	73.0	3.24	2.81	1.91	0.915	78.2	3.62	2.57	0.993	65.4	3.03	2.78	13.57	2.67
General average . .	72.8	3.65	2.93	1.52	0.841	77.0	4.01	2.71	0.989	64.9	3.45	2.83	13.19	2.59
<i>Jersey . . . . .</i>	73.4	3.82	2.88	1.15	0.681	77.4	3.12	3.19	0.974	63.0	2.18	3.21	13.85	2.43

The weight of the stomachs and intestines, and consequently of the internal organs as a whole are a higher percentage of the live-weight of the animal in Jersey calves than in Hereford calves. The weight of the hair and hide and possibly of the skeleton of the Hereford calves is higher in proportion to the live-weight than in the case of the Jersey calves. There is no apparent difference in chemical composition due to breed.

As regards the effect of the feeding of the cow during the gestation period (Herefords), it was found that the live weight of calves at birth from the high and medium planes of nutrition were practically the same, whereas that of calves whose dams were insufficiently fed was appreciably lower.

As regards the separated parts of the animal, the proportion of flesh

decreases and the proportion of skeleton and internal organs increases as we pass from the high plane of nutrition to the low plane.

Taking the average composition of the calves the proportion of fat and nitrogen decreases and that of moisture, ash and phosphorus increases as we pass from the high to the low plane of nutrition. Most of the fat of the new-born calf is found within the internal organs; the flesh and skeleton also contain fat but in small proportions. The sum of the percentages of moisture and fat, and consequently the percentage of moisture-free substance tends to a constant value, regardless of the plane of feeding of the dam.

IV. — THE NORMAL GROWTH OF DAIRY CATTLE. — In a preceding treatise (1) the factors influencing the rate of growth and the size of dairy heifers was studied. In the present Research Bulletin a more detailed study is made for determining the processes of normal growth and how it is attained.

The authors in order to arrive at a decision plotted the growth curve from birth to maturity (as represented by weight and height at withers), for cows of the Jersey, Holstein, Ayrshire and the dairy type of Shorthorn. They also collected data showing the average height at withers and weight of mature Jersey Holstein and Ayrshire cows.

Curves of this character are useful in research work as a basis of comparison for the growth of experimental animals. The figures of normal growth may be of considerable assistance to breeders of dairy cattle, giving them a means of determining whether their methods of feeding growing animals are such as to allow growth to continue at a normal rate, and to judge if an individual animal is of normal size for its age.

Table IV and V give some of the most important data.

TABLE IV. — *Average Weight of Jersey, Holstein and Ayrshire Cows from 1st to 5th Calving.*

	Holsteins		Jerseys		Ayrshires	
	Age	Weight	Age	Weight	Age	Weight
	Months	lb.	Months	lb.	Months	lb.
After 1st calving . . . . .	30	965	29	764	28	868
Six months after first calving . . . . .	36	962	35	779	34	840
After second calving. . . . .	43	1040	42	827	37	874
Six months after second calving . . . . .	49	1071	48	854	43	892
After third calving . . . . .	57	1143	55	872	55	960
Six months after third calving . . . . .	63	1136	—	—	61	952
After fourth calving . . . . .	71	1219	68	887	74	1022
Six months after fourth calving . . . . .	77	1200	—	—	80	980
After fifth calving. . . . .	82	1247	80	919	92	1045
Six months after fifth calving . . . . .	—	—	—	—	98	1023

(1) Summarised in R. October-December 1910, No. 1188. (Ed.)

TABLE V. — *Average Height and Weight of Mature Dairy Cows.*

Breeds	Height at Withers	Weight
	cm.	pounds
Jersey American type . . . . .	123.7	902
" All types . . . . .	121.6	—
Holstein <sup>a</sup> . . . . .	134.8	1245
Ayrshires . . . . .	123.6	997

V. — STUDIES IN ANIMAL NUTRITION: CHANGES IN FORM AND WEIGHT ON DIFFERENT PLANES OF NUTRITION. — About 60 Hereford-Shorthorn beef steers were fed from a few weeks of age on milk, lucerne hay, and a grain ration of maize chop + whole oats + linseed meal in the ratio of 6: 3: 1. The ratio of grain to hay was: 2: 1. The animals were weaned at ages varying from 2 to 7 months.

Three planes of nutrition were used 1) Full feed from birth; 2) Feed to produce maximum growth without appreciable fattening; 3) Feed for scanty and retarded growth. The length of the feeding period varied from a few weeks to 4 years.

The average daily increase in live-weight for the 4 years was 1.30 lb. for Group I 0.80 lb. for Group II and 0.65 lb. for Group III. The cost per lb. of gain was 12.24 lb. of dry matter for Group I, 11.91 lb. for Group II, and 11.03 lb. for Group III.

The growth of the Group I animals, as shown by height, width and length measurements, is considered as representing normal growth for this type of cattle. Growth is more rapid at the earlier ages and becomes much slower when the animal is older.

At 4 years the normal beef steer should be 140 to 150 cm. in height at the withers and hips, about 65 cm. wide at the hips and 187 cm. long from shoulder to rear of ischium. The heart girth should be about 250 cm.

The scantily fed cattle grew less rapidly in all respects. But when 4 years old they were of the same height as the full fed group. The age at weaning or at which they were put on poorer rations seems to have had no effect upon the ultimate height. Even a long maintenance period during the first year made no difference to their height.

The poorer rations brought about a material decrease in length, width and circumference of body, and in body weight. The animal kept at body weight maintenance for the greater part of a year failed to catch up in these respects even after 3 years.

The different rations fed seem to have no effect upon the breaking strength of the bones other than such as was due to increased weight. For all 3 groups the breaking strength was a function of the live weight. The formula is approximately  $L = 16.5 W^{.68}$ , where  $L$  is the breaking load and  $W$  is the live-weight.

For very fat Group I cattle this gives results much higher than the observed breaking load.

F. D.

281 - **Hay Made from Liberally Fertilised Young Grass, a Farm-Grown Concentrated Food.** — I. NEUBAUER, Die Gewinnung von jungem Grass nach starker Stickstoffdüngung, ein Mittel zur Erzeugung von Kraftfutter in der eigenen Wirtschaft, in *Biedermann's Zentralblatt*, Year 4, Part 7, pp. 272-275. Leipzig, July 1921. — II. HÜTTINGER, Welche Nutzwendungen muss der practische Tierzüchter aus den Kriegserfahrungen für die Züchtung seiner Nutztiere ziehen? in *Deutsche Landwirtschaftliche Presse*, Year 49, No. 1, pp. 1-2. Berlin, January 4, 1922.

I and II. — NEUBAUER and HÜTTINGER point out the economic importance of a farm being self-supporting, especially as regard stock-feeds including concentrates.

Hay made from young grass possesses the two qualities necessary for concentrated feeds, a low fibre content and a high percentage of protein (20 to 23 per cent of dry matter as against the 12 % found in ordinary hay). As a concentrated food, young grass (the dry matter content being equal) has almost as high a value as brewers' grains, and it is also a very wholesome diet.

NEUBAUER carried out his experiments in a good meadow on the lower Rhine. One part of the ground was mown 3 times in the year, and another every 2-4 weeks (at longer intervals in periods of drought). A portion of the latter plot was left unfertilised, while the other was liberally dressed with sulphate of ammonia each time the grass was cut, from 12 to 16 quintals of the fertiliser being applied per annum. The results obtained are given in the following Table.

*Effect of a Nitrogenous Fertiliser on the Production of a Meadow.*

Years	3 cuttings per annum without fertiliser		From 6 to 8 cuttings per annum			
			Unfertilised		Fertilised	
	Dry matter per hectare kg.	Protein per hectare kg.	Dry matter per hectare kg.	Protein per hectare kg.	Dry matter per hectare kg.	Protein per hectare kg.
1916 . . . . .	10 364	1 483	6 575	1 325	10 358	2 265
1917 . . . . .	6 277	884	4 603	862	7 934	1 706
1918 . . . . .	6 807	947	4 299	912	8 169	1 954
1919 . . . . .	—	—	4 108	685	7 465	1 375

The fertiliser increase the grass-crop by about  $\frac{1}{3}$ ; the dry matter content, whether expressed as weight or as starch value, was increased in about the proportion of 100 to 180; the protein content was nearly doubled.

F. D.

282 - Connection between Degree of Milling and the Composition and Food Value of Bran. — HONCAMP, F., and NOLTE O., in *Landwirtschaftliche Versuchs-Stationen*, Vol. XCVI, pp. 121-142. Berlin. Summarised in *Biedermann's Zentralblatt*, Year L, Part 7, pp. 266-268. Leipzig, 1921.

Table I gives the results of the analyses of rye and wheat brans obtained with various degrees of milling. The authors fed these brans to lambs and determined the coefficient of digestibility for each constituent; the percentages of digestible nutrient substances given in Table II were thus obtained.

TABLE I. — *Percentage Composition of Brans  
Obtained by different Degrees of Milling.*

		Organic matter	Crude Protein	Pure Protein	h-free extracts	Crude fats	Crude fibre	Ash
<i>Wheat bran</i>								
	Milling 75 %	94.97	17.02	15.56	65.62	4.61	7.72	5.03
	" 83 "	93.89	17.32	15.33	62.18	5.08	9.31	6.11
	" 94 "	95.28	15.28	13.21	62.62	4.28	13.10	4.72
<i>Rye bran</i>								
	Milling 65 %	96.41	15.51	13.35	74.14	3.30	3.46	3.59
	" 84 "	96.07	16.37	14.80	70.50	3.87	4.33	4.93
	" 94 "	92.52	19.04	17.08	57.87	4.99	10.62	7.48

TABLE II. — *Percentage of Digestible Nutrient Substances  
Obtained by different Degrees of Milling.*

		Crude protein	Pure protein	N-free extracts	Crude fats	Crude fibre	Starch Value
<i>Wheat bran</i>							
	Milling 75 %	14.36	12.9	52.82	4.05	2.13	51.2
	" 83 "	14.19	12.2	46.95	4.29	3.71	48.1
	" 94 "	11.02	8.9	30.12	3.45	4.89	40.0
<i>Rye bran</i>							
	Milling 65 %	12.08	9.9	64.28	2.53	2.06	57.4
	" 84 "	12.77	10.2	60.42	3.01	1.78	54.9
	" 94 "	14.85	12.8	26.74	3.97	5.89	33.4

These data prove that the degree of milling is a good measure of the food value of a bran, the finer the milling, the lower is the value of the bran.

F. D.

283 - Colour Inheritance in Mammals and Domestic Birds (1). — PORCHEFEL, A., in *Revue vétérinaire*, Vol. LXXII, No. 9, pp. 541-548; No. 11, pp. 680-690. Toulouse, Sept. and Nov. 1921.

The author shows in the first place that the germs of the elements constituting the various colours of the plumage, fur and coats of the dif-

(1) See R. Jan. 1920, No. 81; R. Aug. 1921, No. 832. (Ed.)

ferent breeds which have been evolved are to be found in the plumage, fur and coats of the primitive types from which these breeds are derived. He then investigated colour inheritance and gives a summary of several studies on this subject and finally describes his own experiments with rabbits.

MAMMALS. — As regards *cattle*, Marcel VACHER (1) reached the following conclusions :

1) Red bull and cow:  $\frac{5}{8}$  of the progeny are red and less than 1 % are white.

2) If one of the parents is white and the other red, 90 % of the progeny are roan, 4 % red and 6 % white

3) Two white parents nearly always produce white offspring

4) One white parent and the other piebald-red or roan have red, white and roan calves in variable proportions.

5) Two roan parents produce offspring of all the various colours and shades of coat met with in the Durham breed, viz. red, roan and even white

6) The first calf of a Charolais bull and a red Durham cow was a heifer with light-red coat, all the cows from this first cross were served by a white Charolais bull, and only 6 % of the progeny were white

As regards *horses*, many data have been collected

According to WILCKENS, 5743 matings of animals registered in the English Studbook (3016 of the animals being pure-bred, 1865 English half-bloods, and 861 pure-bred or half blood Arabs) gave the following results :

English thorough-breeds a) parents of the same colour transmit their coat colour in the proportion of 85.6 % ,

b) when the parents are of different colours 43.7 % of the offspring inherit the coat colour of the sire, 50.8 % that of the dam, 5.5 % differ in colour from both sire and dam

When the parents are of the same colour, a chestnut coat is the one most frequently transmitted 97.6 p 1000

If the parents are of different colours, bay appears in 50 to 60 % of the foals.

In similar cases, black is much more rarely transmitted. 10 % only of the foals being black.

The same proportions occur in half-blood English horses

When pure-blood and half-blood Anglo-Arabs are of the same colour, they transmit their coats in 83.7 % of the cases

Should the parents be of different colours, 31.3 % of the foals inherit the sire's coat, 50.6 % the dam's coat, and 12.1 % do not inherit the coat of either sire or dam.

White or light-grey parents transmit their coat colour in 90 % of the cases.

(1) M. VACHER, Transmission de la couleur chez les animaux de la ferme *Bulletin de la Société Nationale d'Agriculture de France*, 1905 (Author's note)

If they are of different colours, white is dominant in 73 % of the cases.

Bay is transmitted in 55.1 % of the cases, and black in 19 %.

CABRIFORCE (1) by examining the pedigrees of 197 horses at the annexe of the Saint-Julien remount Station obtained the following data

The offspring of a stallion and brood-mare of similar coat colour usually inherit the coat of the parents (81%). In such cases, chestnut is the colour that is most likely to be transmitted, occurring 95 times out of 100 whereas bay is only inherited 77 times out of 100. When a stallion and mare of different coat colours are mated, the offspring nearly always (90 times out of 100), inherit the colour of one or other parent.

The dam seems to exercise a preponderant influence upon the coat-colour of the offspring ; 58.5 times out of 100 the foals are the colour of the mare and only 41.5 times in 100 do they inherit the coat-colour of the sire

A chestnut coat which is so surely transmitted, when both parents are chestnuts, also occurs frequently when one of the parents is a chestnut, or even when both are of another colour ; 39 matings of a bay stallion with bay mares gave 9 chestnut foals, of which 3 were dark chestnut with mane, tail and legs darker than the coat. Grey coats are also transmitted in rather high proportions :

a) 22 matings of chestnut stallions with grey mares resulted in . 50 % grey foals ; 36.3 % chestnuts , 9 % bays ; 4.5 % blacks.

b) 6 matings of a grey sire and chestnut dam resulted in . 3 grey offspring and 3 chestnuts

c) From 10 matings of a grey sire and grey dam were obtained : 40 % bay foals ; 50 % grey , 10 % chestnut

d) 11 matings of a grey sire and grey dam resulted in . 54.5 % grey foals , 36.3 % bays , 9.0 % chestnuts

e) From 2 matings of grey parents 1 grey and 1 chestnut foal were obtained

A black coat is transmitted with the greatest difficulty . 11 animals with black coats (6 stallions, 5 mares), on being mated with animals of a different colour, transmitted their coat once only.

a) A chestnut sire mated with a black mare produced one brown-bay foal ;

b) Four other matings of bay sire with a black mare gave 3 bay foals and one chestnut ;

c) Four matings of black sire with bay dam produced 1 black foal, 1 chestnut and 2 bay, of which 1 was a dark brown-bay ;

d) With a black sire and chestnut dam a brown-bay was obtained ;

e) With a black stallion and a grey mare, a dark-grey foal was obtained.

CABRIFORCE's statements as regards the influence of the dam's

1) CABRIFORCE, Observations hippiques sur le contingent de 1899 Influence des reproducteurs sur la robe des produits, in *Recueil de memoires et observations sur l'hygiene et la medecine veterinaire militaire*. (Author's note)



coat-colour upon that of her offspring, the difficulty of transmitting a black coat and the facility with which chestnut and grey coats are inherited entirely corroborate the statements of WILCKENS.

DUPAS, quoted by FLORIOT (1), has also collected some data respecting the 300 horses at the Fontenay-le-Comte Remount Station which may be summarised as follows:

1) Inheritance frequency of coat-colour: *a*) bay, is transmitted 208 times out of 310 (66 %); *b*) chestnut is transmitted 87 times out of 181 (48 %), roan, is transmitted 5 times out of 11 (45 %), grey, 5 times out of 30 (17 %), black, 3 times out of 25 (12 %).

2) Sex influence. Stallions transmit their coat colour more frequently than mares, the transmission percentage being 48 for the former and 39 for the latter.

8) Transmission of coat-colour of parents when sire and dam are of the same colour 85 % of the offspring inherit this colour a chestnut coat is more easily transmitted (91 out of 100 times) than a bay (83 out of 100 times).

In *summa*, a white coat is most easily transmitted. As regards rabbits Gustave LOIZEL (2) has drawn the following conclusions from the results of his experiments.

From a black buck-rabbit mated with a Russian doe, 9 black young were obtained.

A grey buck-rabbit mated with a Russian doe produced a litter of 8 grey and 3 black. These young rabbits, when mated together, produced 74 offspring, of which 58 had the characters of the grey rabbit and 16 those of the Russian rabbit.

As was to be expected in such close in-breeding, the young Russian rabbits of the last litters showed a tendency to lose the coloured spots characterising the breed, and for the same reason, large white patches appeared on the head and shoulders of the young grey rabbits of the same litters.

The mating of a white Angora buck-rabbit with a grey doe-rabbit resulted in 3 litters of 26 grey young with black eyes, which either inherited from the male brushes of long hair underneath their paws or else were entirely grey-Angoras.

An ordinary dark-grey buck-rabbit with white on the forehead, tip of the nose, the neck and tips of the fore-paws, when mated with a white Angora doe-rabbit produced in 3 litters, 9 young, all resembling the breed of the buck, and with white markings distributed as follows; one dark-grey rabbit had a white star on its forehead, another was dark-grey with a white star on its forehead and white tips to its fore-feet, a third had the

(1) FLORIOT, L'hérédité chez le cheval, *Revue vétérinaire militaire*, Dec 1913. (Author's note)

(2) G. LOIZEL, Recherches sur l'hérédité des caractères du pelage chez les lapins, *Comptes rendus de la Société de Biologie*, Feb 3, 1906 (Author's note)

front half of its body and half its head white, the rest of its body being dark-grey.

Saint-Yves MÉNARD mated a white Russian buck-rabbit with a silver-grey doe-rabbit and obtained black offspring.

These black rabbits when mated produced black young for 3 or 4 generations, but in the 5th generation one white rabbit with black feet was found in the litter; this was a case of atavism.

The author's experiments made in collaboration with Prof. BOUCHER yielded the following results:

1) A black buck-rabbit on being mated with a white doe-rabbit, produced: 2 black young, 1 dark silver-grey with white head.

2) Black buck-rabbit  $\times$  white doe-rabbit: 5 grey, 2 black.

3) A black rabbit resulting from experiment 1, on being mated with its dam (a white rabbit), produced 3 black and 1 white. The proportion of pigmented individuals was larger than that of the white; in the last case the young were  $\frac{3}{4}$  white rabbit blood and  $\frac{1}{4}$  black rabbit; in experiment 2 there was a throwback to fawn-grey. This atavism is proved by several other series of experiments made by the author and has been confirmed by COLLIN (1) who says he frequently saw little red rabbits resembling their grandfather amongst the white individuals of each litter resulting from the several matings of white doe-rabbits with black buck-rabbits.

BIRDS. — From 1893 to 1903, Gustav LOIZEL (2) studied the inheritance of plumage colour in the carrier-pigeons of the military pigeoncot at Vaugirard and came to the following conclusions.

1) If 2 pigeons of similar plumage are mated, 85 % of the young birds will have the same plumage as their parents

2) If 2 pigeons of different plumage are mated, their progeny will vary, according to the mixtures, in the following proportions:

a) The mixture mottled blue gives: 62 % mottled birds; 37 % blue and 0.88 % with new plumage colours.

b) The mixture mottled red gives 42 % mottled birds; 46 % red; 12 % with new plumage colours

c) The blue-red mixture gives 13 % blue birds; 36 % red; 50 % with new plumage colours

d) The white-blue mixture gives: 36 % blue birds; 40 % white; 24 % of new plumage colours

e) The white-mottled mixture gives: 33 % mottled; 44 % white; 23 % with new plumage colours

Certain colours of plumage are dominant over others, thus mottled is dominant over blue, red over blue, and white over blue and mottled.

The progeny of the same pair, generally remains the same every year, at least for 4 consecutive years, when the parents and grandparents had the same plumage.

(1) G. COLLIN, *Traité de Physiologie*, 2nd edition, Vol II, p. 701 (Author's note)

(2) LOIZEL, *Études sur l'hérédité de la coloration du plumage chez les pigeons voyageurs* Comptes rendus de la Société de Biologie, Mar 11 1905 (Author's note)

The plumage colour of the young birds differs every year, however, when the parents have plumage of different colours.

If the genealogy of given pairs is followed for a certain number of generations, new colours are sometimes found to occur without the possibility of tracing them in the progenitors, even as far back as the 8th generation.

As a result of his numerous observations, the author concludes that "colour like every other character depends upon the parents' capacity of transmission, but some colours such as chestnut and grey in the case of horses are more easily transmitted".

When animals are the result of hybridisation or crosses between individuals of different breeds, there is no fixed rule as to colour-transmission and atavistic colours may occur to such an extent that colour-inheritance is in abeyance.

When however the breeds have long been subject to selection, and great care has been taken to insure uniform coat colour, as is the case with many breeds of cattle, the results are perfectly certain.

Coat colour resembles all other characters: the greater the number of the generations, the more likely it is that the organism will be imbued with the breed elements and the less the risk of any new characters arising, provided the environment remains the same " F. D

284 - **Mutations observed in the Skunk (*Mephitis pudita* and *M. hudsonica*) in the United States.** - DILLFUS, J. A. (Laboratory of Genetics, Illinois Agricultural Experiment Station) and HOB BROOK, F. M. (Skunk Development Bureau, White Plains, N. Y.), in *Journal of Heredity*, Vol. XII, No. 6, pp. 243-254, figs. 5, Washington, 1921

The authors give a short account of the fur trade in the United States which has increased during the last 10 years to such an extent that instead of exporting raw furs to Europe, America is even in a position to import skins to be dressed and made up in the country. One important source of the native supply is the skunk (*Mephitis* spp.) (1) which is bred in captivity or in a state of semi-domestication. The authors then describe their experiments in skunk breeding, the mutations obtained and their hereditary behaviour.

So far they have discovered 12 mutations in *M. pudita*, and 3 in *M. hudsonica*. Mutations are evidently fairly frequent in this genus, and have also been observed in skunks captured in various States. There are 5 distinct types of mutation: 1) self-black; 2) seal-brown white with stripes; 3) black-eyed white; 4) white with a small amount of pigment in eyes; 5) pure albino. The 3 different albinotic types represent simple changes in single genes and therefore each gives a monohybrid ratio when crossed with the wild form. There is no evidence that they may be multiple allelomorphs. The appearance of mutations is increased by in-breeding.

There was a great preponderance of females among the skunks born (37 out of 56). F. D

(1) See R. August 1921, No. 540. (Ed)

285 - Measurement of the Cutaneous Surface of the Horse. — ROUSSY, B., in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 3, pp. 195-196, fig. 1. Paris, January 16, 1922.

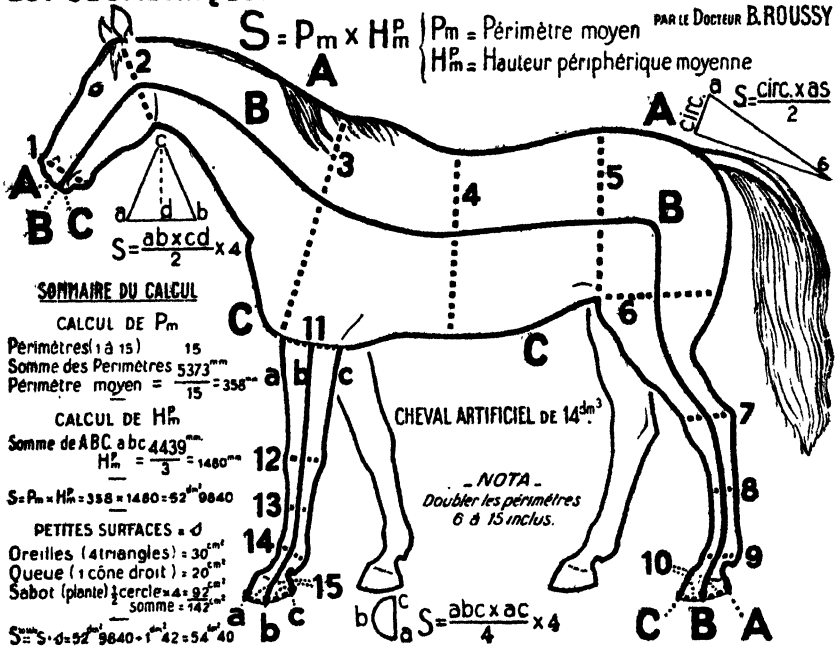
From measuring the surface of the human body, the author discovered the "geometric law":

$$S = H^m \times P^m$$

where  $S$  represents the body surface,  $H^m$  the mean peripheral height and  $P^m$  the mean perimeter.

## LOI GÉOMÉTRIQUE DE LA SURFACE TOTALE "S<sup>totale</sup>" DU CHEVAL

PAR LE DOCTEUR B. ROUSSY



Although convinced that this law is general, that is to say applicable to all measurable bodies, he wished to test it also upon quadrupeds beginning with the horse.

His first experiments were made on a small artificial horse and the results tested by covering the living animal with an artificial skin, which was afterwards removed, the pieces being laid out on a flat surface and their plane area determined; sometimes they were photographed.

In this way, he obtained a total measured surface of 54.37 dm<sup>2</sup>, as against 54.40 dm<sup>2</sup> calculated according to the geometric law. The results thus practically agree, the difference being only 3 cm<sup>2</sup>.

The examination of the appended figure will explain the processes by which the "geometric law" was evolved.

**DETERMINATION OF THE MEAN PERIMETER  $P^m$ .** — With a flexible accurate measuring-tape properly applied measure the perimeters alternately of the flattest and the most rounded contours of the head, neck trunk, one hind-leg, and one fore-leg, as is shown by the dotted lines. In this manner, are obtained 15 perimeters numbered 1-15.

The measurements 10 and 15 are those of the lower border of the left side of both hoofs.

In order to obtain the measurements for the two other limbs, double the perimeters 6 to 15 inclusive. The sum of the 15 perimeters, 5373 mm. divided by their number (15) will give the mean perimeter  $P^m$  which is 358 mm.

**DETERMINATION OF THE MEAN PERIPHERAL HEIGHT  $H^m$**  — Measure (following all the curves of the skin), the chief out lines  $A$  ( $C$ ) and the line  $B$  drawn along the middle of the lateral surface of the animal, and then measure the three small lines  $a$   $b$   $c$  on the left fore-leg.

The sum of these 6 lines (4439 mm. in the given case), on being divided by 3 (the common divisor of the two series of lines), gives the *mean peripheral height*  $H^m$  which is 1480 mm.

The surface  $S$  of the horse is  $P^m \times H^m = 358 \times 1480 = 5289 \text{ dm}^2$ .

This result being very satisfactory might be adopted. If however desired, the negligible sum, 142 Sq. dm.(s) of the small surfaces of the ears, tail and soles of hoofs can be added (as was done above), and this gives the total surface ( $S^{\text{total}}$ ) of 5440 Sq. dm. F. D.

286 — **Characters of the Chilean Horse.** — CORREA, A. V., JETTELIER, M., IVAN DE D. RODRIGUEZ, VIAL, D. G., in *El Agricultor, Revista de la Sociedad Nacional de Agricultura (Chile)* Vol. VI (Vol. 52 of the *Boletín*), p. 201, No. 10 Santiago de Chile, October 1921.

Report of the Commission appointed by the Managing Board of the National Society of Agriculture and approved by the Society at its meeting of 1 August 22, 1921.

**GENERAL CHARACTERISTICS.** — The Chilean horse belongs to a very muscular type; it is heavily-built, but agile, and its movements are swift.

The chest girth varies from 1.62 m. to 1.82 m. according to the animal's height which is from 1.35 m. to 1.50 m.

**CHARACTERS OF THE BREED.** — *colour* variegated; as a rule, the coat is of two distinct colours, or there is a little white on the forehead and legs.

*Skin* thick; little hair on fetlocks; mane and tail generally thick, hair wavy.

*Head* light, of medium length, forehead broad and flat, profile straight or slightly convex; eyes bright, slightly covered by the superciliary arch; ears small and mobile.

*Neck* of average length, wide at the base which is strongly joined to the scapula; slightly convex in the upper portion, full and nearly rectilinear in the lower, slender at its junction with the head.

*Withers* usually too low, short and buried in masses of muscle. It

is necessary to improve the withers with a view to the saddle ; they must be enlarged and made more prominent without the exaggeration seen in the pure-blood or hunter.

*Shoulder* very muscular but sometimes too short and too straight. Its slope and length must be increased in order to obtain the quickness of movement required in a saddle-horse.

*Chest* wide, muscular, shoulder-blades well separated.

*Back* very muscular, sometimes a little long and low where it joins the withers. It should always be strong and short (the length of the horse being obtained from a sufficient slope of the shoulders) with long withers, haunches and croup.

*Haunches* wide, muscular, strongly joined by a straight sometimes slightly convex line to the croup.

*Croup* long, full, slightly inclined. The tail is inserted rather low and is therefore generally pendent, or a little turned up at the lower part.

*Trunk* well-developed, ribs round, barrel cylindrical, and flanks short and full.

*Fore-legs* : fore-arm long straight, arm properly inclined, elbow free from chest, both very muscular ; knee strong and wide ; cannon-bone of average length relatively slender ; seen from the side it should be wide, sinews strong and standing well apart.

*Hind quarters* : haunch very muscular ; the croup must be long, the leg wide, muscular internally and externally, hock dry and strong, sometimes a little narrow from the front view. The wide space between the legs when the horse is in motion is characteristic of the breed. It denotes strength and energy but must not be exaggerated, for thus the harmony of the animals' movements is unpaired.

*Articulations* : small, round and very dry.

*Pasterns* : short, strong, must have sufficient slope to be very elastic.

*Hoof* : relatively small, high ; sole concave, frog little developed.

*Character* : Docile and a good worker.

#### DONKEYS

287 - **The Donkey of Catalonia, Spain.** -- ROSILL Y VILA, M. (Profesor de Zootecnia de la Escuela Superior de Agricultura, Madrid), in *El Cultivador moderno*, vol. VII, No. 1, pp. 3-5 figs. 3. Barcelona, January 1922.

The Catalonian donkey is a native breed, as can be seen from prehistoric drawings and the neolithic remains.

The chief characters peculiar to the breed are described exhaustively by the author. They are as follows : head with rectilinear outline in adult animals, with double frontal convexity in young individuals, brachycephalous in type 0.56 m. to 0.68 m. in length ; ears straight and long (0.38 m. to 0.42 m. in length) ; height 1.35 m.-1.65 m. ; neck slender ; shoulder not very sloping ; withers little raised and distinct ; dorsal line straight and long ; chest a little narrow but with spacious thoracic cavity ; chest walls moderately rounded ; croup short with double slope ; sacrum very prominent ; legs slender and strong. The coat of the adult donkey varies between chestnut and nearly black ; the axilla, the flat

portion of the thigh, lower part of chest and of the belly are all silvery white. The muzzle is white as far as the lower third of the nostrils and there is a white circle round the eye. Their harmonious shape, expressive faces and lively temperament give these donkeys a very handsome, high-bred appearance.

The measurements of a good specimen two years of age are as follows : height at withers 1.50 m. ; height at middle of back 1.46 m. ; length of back 1.45 m. ; girth of chest 1.60 m. ; circumference of tibia 22 cm. ; weight about 350 kg. The female donkeys give an extraordinary amount of milk, the lactation period is long and may even last 18 months ; from 4.5 to 5 litres of milk are given daily for a year, the amount decreasing to 2.5 litres at 18 months.

The jack-asses are chiefly used for the breeding of mules and must not be exported after they are 2 years old. Formerly they were exported practically to all parts of the world either for mule-breeding or to improve native races of donkeys in other countries. The price of a good breeding-animal is from 4 000 to 8 000 *pesetas*.

The Catalanian donkeys are of two types, the one inclining to height and the other to width ; the first are found in Comarca de Urgel and the second in Vich and Olot. The broad animals are preferred by the Italian and French importers and the tall by the English (for India, the African Colonies and Australia) and by the North Americans.

The " Mancomunidad de la Cataluña " (Association of all the political parties of Catalonia) (1) has started a stud-book for donkeys in which the only entries are of breeding-animals which have gained prizes at the shows held by the " Mancomunidad " or the progeny of the prize-winners.

F. D.

288 - The Cattle Industry of Cuba. NINETEEN in *The Cuban Review*, Vol XIX, No. 9, pp 13-16, Aug 18 New York August 1921

CATTLE

Cuba is admirably suited to cattle-rearing. The climate is temperate and the temperature varies little which allows of the animals to be left in open pasture all the year round. Care must however be taken during the summer rainy season to remove the cattle from the low wet lands to the adjoining higher country, otherwise foot-trouble may result from the animals being continually in the water. In the dry season of winter, when grass begins to get short and scarce, and water hard to obtain on the higher better-drained areas of the interior, the cattle have to be brought down to the moist pastures at lower levels. Good water is practically obtainable everywhere throughout the Island, especially in the centre of the Provinces of Camagüey and Oriente.

Guinea Grass (*Panicum maximum*) and Para Grass (*Panicum molle*), have been introduced into Cuba and grow luxuriantly, furnishing the best

(1) The " Dirección de los Servicios de ganadería de la Mancomunidad de Cataluña, Calle Urgel, 87, Barcelona ", will furnish information on all subjects connected with Stock-breeding in Catalonia. (Ed)

of pastures, especially for fattening purposes. The former plant prefers the higher lands, the latter does best on the lower. Excessively close grazing will, however, destroy them and their places are taken by the native grasses of Cuba, of which the principal, "espartillo", is an excellent forage plant highly prized for milk production.

The topography of Cuba is favourable to the combination of agriculture with cattle-raising. In the Province of Pinar del Rio, in the southern portion of the Province of Santa Clara, in the northern portion of Camagüey, and throughout a very large area of the Province of Oriente, slightly undulating areas of agricultural land are found bounded by rough broken country in many places still covered with virgin forest, but where the trees have been felled, the slopes are all covered with tall rank grass composed of *Panicum maximum* and *P. molle*.

At the end of the War of Independence, the cattle industry had practically disappeared, but very soon large quantities of stock were imported from Florida, Texas, Mexico, Central America, Panama and Venezuela, and the supply exceeded the demand; this continued for some years.

In 1915 however many stock-breeders began ploughing up their pastures and planting them with sugar-cane. This change though slow at first, gradually became more rapid and reached its climax in the spring and early summer of 1920. The necessary results were a decrease in cattle production and increased importation.

Thus while from 1907 to about 1919, only breeding stock were imported, some 20 000 head of cattle were introduced in the 2 following years, the animals coming chiefly from Venezuela, Colombia and Costa Rica; a few have recently been imported from the United States. The animals imported after the War of Independence constituted, with their offspring, what might be called the native breed of cattle. They still exist in countless herds and are of a non-descript heterogeneous type. They are, however, being improved by progressive breeders through the introduction of high-class pedigree sires of the Polled Angus, Hereford, Durham and Zebu breeds.

Some cattle-raisers greatly prize the Polled Angus race, as it has proved able to adapt itself to the climatic conditions of Cuba-is resistant to ticks and diseases, and produces fine beef-cattle.

The Hereford is also favoured, but is regarded by some breeders as a lazy animal which does not make full use of the grazing-ground.

The Zebu is perhaps the greatest favourite; it is almost tick immune, of good form and excellent as a beef animal.

As a result of the introduction of the Zebu and the Polled Angus, a vast number of cattle have been improved, the animals being heavier and producing meat of better quality.

The large Cuban sugar crop is hauled from the field to the railway loading stations in carts drawn by oxen of which 3 to 5 yokes are required for each cart. Assuming the annual amount of cane transported to be 36 360 000 long tons, it takes about 8 million cartages to haul it, each cart-load being 4 5 tons. Thus a great number of cattle are needed for



the work and it would be advisable to raise special breeds for the purpose. Among the favourites adopted by the Cubans almost from their first introduction has been a strain from Porto Rico consisting of heavy animals, of excellent disposition, easily trained and taking readily to the work. Certain types of Colombian and Venezuelan cattle have been found to be well adapted for use in carts. Cattle with a certain amount of zebu blood are much faster than the other strains used, but their wildness and the consequent difficulty in handling them is a great drawback.

The law requires that all cattle imported into the Island from South and Central America, Mexico and Texas should be dipped (to free them from ticks) at the port of introduction. In nearly all the better ranches of the interior, dipping has been adopted as the best means of getting rid of tick, but it is not compulsory. The subdivision of pastures and the systematic transfer of cattle from one subdivision to another with a view to the complete eradication of ticks has not yet been adopted.

The raising of stock in connection with the sugar-mills has not been fully developed.

The estimated consumption of cattle in Cuba is about 1000 head per day. Modern up-to-date abattoirs are rare in the Island; there is one at Camaguey and other at Havana. An attempt has been made to instal refrigerating plants, but without success for the Cuban has a prejudice against refrigerated meat, and when meat has been kept on ice at the butcher's it has to be sold as second grade meat.

The acreage under sugar-cane will probably decrease, which will result in an increase in the land available for pasture and hence in the number of cattle raised. A tremendous drop has already taken place in the price of cattle. Yearlings which fetched at least 45 dollars per head in 1920, could be bought for 15 dollars in the second half of 1921. F. D.

289 - **Improvement of Dairy Cattle by Milk Control in Denmark.** - FABER, A (Agricultural Commissioner to the British Government), in *The Journal of the Ministry of Agriculture*, Vol XXVIII, No 7, pp 598-602, figs 1, No 8, pp 701-711, figs 2. London October and November 1921.

The first Danish Milk Recording Society was instituted at Vejen, in 1895 under the name of "Vejen Kontrolforening". The aim of this society was to ascertain the quantity and quality of the milk yield of individual cows in order to be able to eliminate the animals that did not pay for their keep and to reserve the best cows for breeding purposes. When the Vejen Society had been working for a year, it was found that the best of the controlled cows produced a pound of butter at the cost of 6d and the poorest cow produced a pound of butter at the cost of 2s 8d.

By the Law of 1902 the Danish Government made a grant not exceeding £10 to each Milk Recording Society of at least 10 members with 200 cows, on condition that the Societies should help to form better strains of dairy cattle. This grant was renewed by the Law of 1912.

The results of the institution of Milk Control Societies were: an increase in the general average of milk production, the adoption of a more

liberal teeding for cows, a selection of breeding-animals based, not as before, on external conformation alone but also on an exact knowledge of the quantity and quality of the milk produced and on the ability of the cow to transmit her character as a milk producer to her progeny.

The good results obtained by these Societies are shown by the records of those of Funen. These were founded in 1899-1900, in which year they controlled 5467 cows, the number rising in 1915-1916 to 40 116. The average annual milk yields of all the cows (whether in milk or not) belonging to the Societies being for these two years, 6 822 lb. and 7 938 lb. respectively; the fat percentage being 3.36 and 3.55, and the butter yield 255 lb. and 323 lb. respectively.

The Danish dairy farmer breeds his own cattle; he adopts in-breeding or line-breeding, thereby forming families.

Family herd-books are a special feature of Danish cattle-breeding, their value depending to a great extent on the work of the milk-recording societies. These herd-books have proved that the greater the number of high yielding animals a cow can count among her ancestors, the more likely she is to transmit the quality of high yield to her offspring. The author reproduces two specimen pages of the Book of Record Sheets on which are entered not only the cows' performance but also details relating to her ancestry and progeny. The family herd-books are not drawn up by the Controller of the Milk Recording Societies, but by the Agricultural Advisers appointed by the Agricultural Societies or the Joint Committees of Breeding and Milk Recording Societies. The State pays part of the salaries of these advisers.

About 1880 official herdbooks were started which are to some extent based on the family herd-books. These official herdbooks give the description and pedigree of the animal, as well as the milk and butter production in the case of a cow, and the performance of its female progenitors in that of a bull.

In order to find herds which not only contained prominent animals but consisted of families from which a good supply of breeding stock could be obtained for the improvement of other herds, competitions were carried out for one year at a time; later, these competitions lasted two years. The first was held in Funen in 1894-1896 and the 7th in 1913-1915. Another series was begun in Sealand in 1897. The best herds were officially recognised as "Breeding Centres".

The results obtained at Funen were as follows: 1st *biennial competition*: 7 competing herds consisting of 530 cows: average annual milk production per head 697 gallons, fat percentage 3.44 — 4th *competition*: 18 herds 777 cows, 853 gallons of milk, at percentage 3.53 — 7th *competition*: 10 herds, 304 cows, 934 gallons of milk, fat percentage 3.83. These competitions between entire herds are a peculiarity of Danish cattle-breeding. The Government encouraged them by annual grants.

An important step forward was made when it was ascertained from the records of the Milk Recording Societies that the capacity of yielding

large quantities of milk with a high fat percentage can be transmitted through the bull to his progeny.

By the Laws on Breeding Domestic Animals (1887 and 1902) grants were made by the Government for prizes for bulls at District Agricultural Shows, under the conditions that the animals were to be kept for service in the country at least until May 1st in the following year and that bulls 5 years old or older should be judged through their offspring. This second proviso gave rise to "Offspring Shows" which are also a special Danish feature. By these means farmers have for a number of years been encouraged to preserve good bulls for service. While in 1887, only 371 bulls were presented at the District Shows, in 1908 more than 1200 were presented at the State Shows, and as many as 250 old bulls are entered at local shows every year.

The law of 1902 offered a further grant of £750 to cattle breeding societies "which by showing superior offspring have proved to be particularly capable of developing good strains of dairy cattle." In order to participate in this grant, the Breeding Societies must exhibit at the Offspring Shows their bulls and  $\frac{1}{8}$  of the total number of their cows, and at least 2 bulls and 24 cows. One fourth of the cows must be between one and two years old and for  $\frac{1}{4}$  at least, two years' milk records must be produced. Breeding Societies have an additional claim to the grant if they have formed or are about to form tribes or families of dairy cattle producing a high yield of butter. When the Law was amended in 1912, further encouragement was offered to cattle-breeding societies having many of their cows under the control of the milk-recording societies. A grant is offered for each bull belonging to a cattle-breeding society when the bull is at least 1  $\frac{1}{2}$  years old and has been awarded certain prizes at shows; the amount of the grant varies according to the proportion of the cows belonging to the breeding society that are being reliably controlled as to their yield of milk, butter production and consumption of fodder.

When the Milk Recording Societies had worked for a considerable number of years and had on their books some 15 000 herds including 250 000 cows or about  $\frac{1}{5}$  of all the cows in the country, a large amount of information was available.

This statistical material was worked up by the Federations of Agricultural Societies. The investigations are now carried on to a large extent by the Officers of the Provincial Federations, the Government defraying part of the cost. These records are used to determine which of the registered bulls influence the milk yield of their progeny, so that it is higher than that of the dam of the bull. Butter production is taken into special account.

Both with the Red Danish Dairy Cattle and the Jutland Breed much of the progress during recent years is due to the influence of a few bulls having remarkably strong power of transmitting higher milk yielding capacity to their progeny.

The use of milk records in the breeding of cattle both by line-breeding and employing bulls selected as explained above, has now been carried

on long enough to show definite results; this is clearly seen by comparing the yield of the herds at two different periods.

Year	Yields of milk	Fat	Yields of butter
<i>Red Danish Breed.</i>			
1905 - 1906	8.941 lb.	3.58 %	356 lb.
1915 - 1916	10.041 "	4.11 "	4 602 "
1905 - 1906	9.427 "	3.40 "	356 "
1915 - 1916	11.282 "	4.30 "	546 "
<i>Jutland Breed.</i>			
1900 - 1901	5.315 lb.	3.09 %	183 lb.
1916 - 1917	8.175 "	3.87 "	354 "
1897 - 1898	5.922 "	3.01 "	196 "
1913 - 1914	8.538 "	3.84 "	367 "
<i>Shorthorns.</i>			
1901 - 1902	6.864 lb.	3.62 %	277 lb.
1911 - 1912	10.164 "	4.06 "	460 "

Averaging 18 herds of all 3 breeds during a period of about 14 years, the milk yield has been increased 26 % and the butter production over 50 %. The improvement has been general throughout the country and is not confined to the stock of eminent breeders, but extends also to that of small farmers. In the opinion of MÖRKEBERG: "the capacity to yield much milk and the capacity to yield rich milk are two different characters, both hereditary, but inherited the one independently of the other." If this is correct, the problem is still easier for a country where a high milk yield is the main object, than for Denmark, where a large production of butter is required.

The rules for Cattle Shows vary a little in the different Provinces; the author quotes as instances some of the rules for the provincial Shows held by the Associated Agricultural Societies in Funen. F. D.

290 - **The Utilisation for Grazing-Grounds of the De-forested Lands of the South of the United States.** -- FARLEY F. W., and GREENE, S. W. (Animal Husbandry Division, Bureau of Animal Industry, U. S. Department of Agriculture) in *United States Department of Agriculture, Bulletin No. 827*, 51 pp., figs. 13. Washington 1921.

The authors, give an account of the cattle-rearing conditions existing in the coastal plain of the South-East of the United States and the value as grazing grounds of the land formerly covered with pine-forests. They describe, the conditions of the climate and soil; system of land tenure; pastures; methods of feeding the cattle; building and shelters for stock; diseases and pests; water supply; the condition of the markets.

At the present time the area of this region (which includes the south-eastern portion of South Carolina, most of Florida, the southern part of Georgia, Alabama, and Mississippi, the central and northern part of Louisiana and parts of south-eastern Texas and of southern Arkansas, is estimated at 100 000 000 acres, and is being increased by about 10 000 000 acres annually as additional land is "cut over". The sandy soil is of sedimentary origin and is the natural habitat of the long-leaf yellow pine (*Pinus palustris*). Although the cattle industry has been growing rapidly since 1910, it has not developed to the full extent possible. The animals are of poor quality owing to various causes, but especially to the cattle tick which makes it impossible to keep pure-bred or grade animals in this district. Mature cows average about 400 or 500 lb. and steers of 3 to 5 years of age average from 600 to 750 lb.

The most important stock-breeding problem is the improvement of the pastures which can be effected by the distribution and protection of *Lespedeza* (Japanese clover), and of *Axonopus compressus* (carpet-grass). The native pastures furnish good grazing from early spring until about July; later, the quality of the grass deteriorates and in the winter, forage has to be fed to the cattle. Amongst the winter feeds the author recommends (as bulky fodder), maize stalks, hay made from leguminosae, cotton seed meal and maize silage (as concentrates), velvet-beans (*Stizolobium* sp.) in the pod.

The author gives the results of a feeding-experiment in which the Mississippi Experiment Station collaborated. This experiment has shown that the same increase of live-weight, at the same cost is obtained by feeding the cattle on maize silage or velvet-bean pods whether crushed or whole. The animals, however, eat the whole pods more readily.

F. D.

291 - **The Value of Beet Molasses in the Ration for Fattening Steers.** GRAY, A. S. in *Facts About Sugar*, Vol. XIII, No. 6, pp. 112-113. New York, August 6, 1921.

An experiment has recently been carried out by the Iowa Experiment Station at Ames with a view to determining whether beet molasses or cane-molasses (both well-known to be excellent feeds for beef cattle), is the more efficient and economical.

Prof. EVVARD finds that when maize sells at 1.71 dollars per bushel, it is cheaper to feed molasses at 45 dollars per ton, but when maize is selling at 50 cents per bushel and 30 dollars per ton is paid for molasses (as in the United States, in 1921) molasses is too expensive.

The experiment was carried out with 5 lots of grade Hereford steers. Lot I which served as a control, received the standard maize-belt ration viz. (for the entire period), 21 lb. shelled maize + 10 lb. maize silage, 5 lb. mixed timothy and clover hay + 3 lb. linseed oil meal.

Lot II received in addition to the standard ration, 2 lb. cane molasses per head, per day but ate 2.5 lb. less maize, 2 lb. less silage, the same oil-meal and less hay than Lot I.

Lot III was fed the same ration as Lot I with the addition of 5 lb. cane

molasses. The animals received up to 8 lb. daily for a while, which was all they could consume, but the extra feed did them no particular good.

Lot IV got the regular ration with 2 lb. beet molasses added. Lot V was fed the standard ration plus 5 lb. beet molasses.

The experiment lasted 120 days. The initial weight of the steers was 1 000 lb. each and the range of weights at the end was 1356 to 1430 lb., the variation being due to the different rations.

The daily increase of live weight was 48 oz. per head and per day on the average for all the groups. All groups with the exception of the Vth showed less increase in weight than Lot I, which showed an increase of 49 oz. per head and per day, the increase for Lot V being just over 48 oz. Both gave a return of 61 % when killed, all the others proving less profitable.

Lot II, III and IV would in any case have showed inferior results to Lot I even if the molasses consumed had cost nothing. On the other hand Lot V, which consumed the maximum amount of beet molasses, made a better use of its food and shewed an increase in weight practically equal to that of Lot I, was sold for practically the same price per lb. of life-weight and as it consumed the least expensive ration really proved the most satisfactory. F. D

292 - **The Sterilisation of Cows.** I GAVARD, G., in *Recueil de Médecine vétérinaire*, Vol. XCVII, Nos. 22-24, pp. 429-433, Toulouse, November 30-December 30, 1921. — I BOUCHET, *Ibidem*, pp. 441-443.

I. After having tried for the sterilisation of cows the crushers of CHASSAIGNAC, FLOCARD and KREBS, BERTSCHY and DEGIVE's elastic ligatures, metallic ligatures, American forceps (all with unsatisfactory results), and also the ovariometers of BERTSCHY and FAVRE which gave better results, although all danger of haemorrhage was not eliminated, the author finally decided to adopt the HESS ovariometer (invented in 1912), which gave him complete satisfaction. Since 1913, he has used this instrument in the Canton of Geneva and the Departments of Haute Savoie and Ain, operating upon 700 to 800 cows annually without a single accident that could be attributed to the treatment.

The HESS ovariometer consists of a double metallic rod and of a movable rod sliding in the fixed part and provided at the end with a screw which is worked by a nut. The movable rod has at the end an oval ring bearing on either side a narrow process fitting into the corresponding slot-hole. A very ingenious type of guillotine is fixed to the apparatus and assists in cutting the neck between the ovary and the extreme limit of the crushed portions. A movable handle, that can be affixed to the rod according to the wish of the operator, gives a firm point of support which allows of great pressure being applied.

The advantage of this angiotribe is that it caused a double crushing and knife is independent and movable, working with a sliding motion, so as to cut outside the laminated margin.

II. — BOUCHET has presented to the Central Society of Veterinary Medicine an ovariometer invented by himself.

This instrument consists of two parts acting as a crusher, that is to say, of a groove in which slides a wormed rod which is drawn down by a nut. At the opposite end, the groove and the screw are both provided with a very wide expansion containing an aperture 50 mm. by 60 mm. through which an ovary can pass. These two apertures correspond when the instrument is open. On moving the nut, the screw is drawn down and with it the aperture at the end of it. This opening then slides in front of the aperture at the end of the groove which remains fixed. This displacement constricts the neck of the ovary which is soon compressed and crushed between the sides of the apertures. These are provided with a projecting ledge furnished with small oblique and opposite incisions forming the two jaws between which the neck is ground. At the extreme limit of their course, the ovary is detached by a blade that only comes into operation after the compressed bundle is crushed.

F. D.

293 - **Possibility of Increasing the Milk Yield of the Charolais Breed.** CHARON, AD J in *Journal d'Agriculture pratique*, Vol. I, No. 3, pp. 80-81. Paris, January 28, 1922.

On January 15 and 16, 1922, a Cattle Show was held at Charolles by the Breeders' Society and the Agricultural Society of the Department of Saône-et-Loire; 150 Charolais cattle, most of them magnificent specimens, were exhibited and proved the remarkable results obtained by selection. The extreme breadth of back, great development of the rump and the width of the hind quarters, all characteristics of the Charolais breed, were accentuated more each year.

Further, there is every possibility of increasing the hitherto low milk-yield of the cows. In fact, nearly all the cows exhibited by one breeder, which were as fine as any of those exhibited, had an extra teat, which is a sign that a milch-cow line could be evolved within the breed.

F. D.

294 - **Sheep-Rearing on Temporary Pastures in the United States.**— MARSHALL, F. R. and POTTS, C. G., in *United States Department of Agriculture, Farmers' Bulletin* 1181, 16 pp., figs. 7. Washington, 1921.

The authors show the economic advantage of temporary pasture in the case of sheep-farms, and describe the systems adopted at the Experimental Farm, at Beltsville (Maryland), where the sheep are turned out at the beginning of April to graze on a field of barley, or rye, and in the summer and autumn are grazed on forage consisting respectively of lucerne, oats and peas, colza, soy-beans and maize; "velvet beans" (*Stizolobium* sp.). These forage crops, which last one year, cover 12 hectares: 20 ares supply on an average 250 grazing-days for 1 sheep. The fields are divided up into plots in each of which the sheep are kept for 14 consecutive days, but not longer. It is advisable for these plots to be rather narrow, so that they can easily be subdivided by small, movable hurdles.

Such a temporary ley, not only supplies food for a greater number of sheep per acre than permanent pasture on equally fertile soil, but it allows the grazing ground to be more frequently changed thus dimin-

ishing the danger of infestation by intestinal worms and other internal parasites.

Further, the temporary pasture as compared with the permanent pasture induces a more abundant milk supply which is more uniformly distributed during the lactation period.

It is wise to cultivate wheat if possible rather than rye, as it makes a better spring fodder. Oats and peas mixed are excellent, although on rich soil, colza makes the cheapest pasturage for sheep. Where the soil is not deep, it should be sown with soy-beans. The sheep may be left out on grass from July until the first frosts.

Lucerne and melilot make excellent toddlers for sheep; especially if precautions are taken to avoid flatulence. F. D.

295 - **Experiments in Rearing Sheep and Goats in the United States.** — I JONES, J M, BREWER, R A and DICKSON, R E, Grain Sorghums Versus Corn for Fattening Lambs, in *Texas Agricultural Experiment Station, Bulletin No 260*, p 13 College Station, 1920 — II MAGLE, W T and DARLOW, A E, Sheep Feeding Investigations, in *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station Bulletin No 133* Stillwater, Okla., 1920 — III MILLER, F C (Sheep Extension Specialist, University of Kentucky), Facts that Sheepmen Desire to Know, in *The Breeder's Gazette*, Vol LXXI, No 5 2095, pp 139 140 Chicago, February 2, 1922

I. GRAIN SORGHUMS VERSUS MAIZE FOR FATTENING LAMBS — Feeding experiments carried out for 90 days and begun on November 26, 1919. Six lots of 20 lambs of the average weight of 59.42 lb were used. In all 6 lots, each lamb received an average ration of 1.08 lb. grain, 0.14 lb. cottonseed meal and 1.89 lb. lucerne hay. The grain fed each lot was respectively: 1) ground milo heads; 2) ground threshed feterita; 3) ground maize; 4) ground threshed milo; 5) ground feterita heads; 6) ground threshed kafir. The average daily increase in weight of the 6 groups per head and per day was respectively 0.362 — 0.36 — 0.393 — 0.394 — 0.339 — 0.372 lb. In order to obtain 100 lb gain the 6 groups consumed respectively: 337.01 — 338.66 — 310.43 — 309.89 — 359.99 — 327.75 lb. of grain + cotton-seed meal 523.02 — 525.60 — 481.76 — 480.94 — 558.68 and 508.65 lb. of hay.

The authors give the analysis of the foods used and their productive value calculated according to FRAPS' system (1).

(1) See: G. S. FRAPS, The Production Coefficients of Feeds in *Texas Agricultural Experiment Station Bulletin* 185, 1916. The value of a feed is measured by the volume which satisfies the appetite of the animal, the content of digestible protein furnishing the material for rebuilding or repairing the muscular tissues, etc., and by its "productive value" which is its value as a source of energy capable of being transformed into internal or external work, heat, fat, etc. This Bulletin describes the method suggested by FRAPS for calculating the productive values of feeds from their chemical composition.

The productive value of a food is defined as follows: the amount of fat which this food would produce in the case of an animal that is being fattened, if it were fed in addition to a basal ration sufficient for the requirements of the organism. The author prefers calculating the productive value in terms of fat, because fat most nearly represents the substance actually measured in the experiments and by adopting this method, there is no need to have



The productive values of the rations used were respectively 16.3 — 20.6 — 20.3 — 18.5 — 16.0 — 14.4.

Lot IV made a slightly larger, but much more economical gain than Lot III, the net profit being 2.73 dollars per head in Lot IV while it was only 1.70 in Lot III.

Lot I made a slightly larger and much more economical gain though Lot V approached very closely.

Ground milo heads (Lot I) give a slightly lower increase in live-weight than ground threshed milo, but were more economical.

This test proved conclusively that for fattening lambs maize shipped into Texas cannot successfully compete with the grain sorghums of the semi-arid sections of Texas which are so well adapted to the production of these non-saccharine sorghums.

## II. COMPARATIVE RATIONS FOR FATTENING CASTRATED LAMBS. —

The feeding experiment began on November 20 and lasted 96 days; the experiment with Lot II was suspended after 70 days. No loss was occasioned by the liberal ration of cotton seed cake. Lot I which was fed a smaller amount did well on the ration until the end of the experiment. From the results summarised in the following Table, it must be concluded that the heads of kafir (a variety of sorghum), are too bulky a feed for lambs. Lot IV (22 lambs) fed on kafir grain yielded a net profit of 10.34 dollars above that obtained from Lot III (22 lambs) which were given kafir heads. The most important result of the experiment was the discovery that the use of silaged darso (a variety of sorghum), reduced the cost of the increase in live-weight. This is seen by comparing Lots III and IV, which were given darso silage, with Lot V which had none.

## III. EXPERIMENTS IN FEEDING AND BREEDING SHEEP AND GOATS. —

The experimental work in sheep husbandry was begun by the Bureau

recourse to any hypothesis as to the amount of productive energy used in the formation of fat, or to any other hypotheses. When the composition and digestibility coefficients are known, it is possible to estimate the fat-producing value of a given food, but in order to simplify the calculation, FRAPS suggests the use of a factor called the "digestibility coefficient", which may be defined as follows: "the factor which multiplied by the food percentage gives the productive value of this food expressed in terms of fat". As the productive coefficient is calculated from the coefficient of digestibility, all that influences digestion also influences the productive coefficient. In the same way, some foods may be regarded as mixtures of two or more ingredients with different digestibility coefficients and different productive values. Non-decorticated cottonseed cake may for instance be regarded as being the residuum of the decorticated seeds plus the integuments of the seeds; the amount of the latter can be estimated from the crude fibre present. Since decorticated seeds and their integuments have different productivity coefficients, the amount of crude fibre will affect the productive coefficient of the feed.

There are similar variations in the composition of other feeds which depend on their different constituents which vary in digestibility and productive values. A table is given showing the productive coefficients based on the average coefficients of digestibility. One column shows the correction method employed for crude fibre, N-free extracts or for both, as occasion arises: — *Experiment Station Record*, Vol. XXXV, p. 561, 1916.

of Animal Industry of the United States in 1906, in collaboration with the Wyoming Experiment Station at Laramie. There are at present e sheep-farms (one at Beltsville Md., and one at Vienna Va.) where the Government is carrying on experimental work in breeding and flock management. The studies include . farm sheep — range sheep — wool and other animal fibres — milch-goat investigations.

The farm flock studies include sheep on temporary pastures, flushing (extra teeding of pregnant ewes) and other means of increasing lamb yields nutrition studies in the growth of sheep, type-fixing in Southdowns and improvement in length of staple and quality of Southdown fleeces.

*Results of Feeding Experiment with Castrated Lambs.  
Length of Experiment 96 Days*

Lots	Ration of Concentrates per head and per day	No. of lambs	Average initial weight per head		Average daily increase per head	Cottonseed cake	Kafir	Sudan Grass	Lucern: hay	Silaged darso
			kg.	gm		kg	kg	kg	kg	kg.
I	170 gm cottonseed cake	21	27.6	90	1.88	(1)	9.29	—	11.51	
II	250 gm cottonseed cake	22	26.4	97	2.58	(1)	8.32	—	9.76	
III	380 gm kafir head.	22	25.4	138	—	2.76	—	6.38	7.21	
IV	360 gm kafir grain . . . .	22	25.5	151	—	2.37	—	5.88	6.53	
V	410 gm. ground kafir . . .	21	26.4	152	—	3.00	—	9.98	—	

(1) Small quantities of kafir were given during the last 18 days of the experiment.

Many good shepherds practise flushing ewes both before and during the breeding season, others, however, do not believe that the advantages are sufficient to justify the practice. In order to throw some light on the question, the Bureau of Animal Industry made an experiment at Beltsville Farm. A total of 302 matings have been studied with the following results. The value of flushing comes largely from the increasing number of turns; 78 % of the ewes with twins lambled in the first half of the lambing season and those that were in best condition were the first to come on heat.

Lamb yields were sufficiently increased to more than balance extra cost of food consumed. Dry feeds gave practically the same results as grass or other green feeds. Ewes given extra rations two weeks before the breeding season began, and throughout the mating season made an average gain of 3.2 kg. per head. At market age the twins averaged considerably less than the singles, but there was practically no difference between twins and singles when fully developed. Records failed to show that twin ewes were more prolific than singles.

Twin lambs do not fatten as early as singles if well nursed from birth.

The Bureau of Animal Industry is endeavouring to produce a type of Southdown uniform in colour markings, of large size and having a denser

fleece with a long staple. So far the light colour markings of the face and legs is practically fixed and the fleece is 20 % heavier and the staple longer than that of the foundation flock.

The range sheep investigation was begun in connection with the Wyoming Experiment Station and transferred later to the Federal Station at Idaho, where the Bureau is conducting experiments along 4 distinct lines as follows :

- 1) Breeding a type of Rambouillet with desirable mutton form.
- 2) Studying types of cross-bred sheep for the purpose of producing the type best suited to range conditions.
- 3) Comparing methods of utilising land for sheep-raising and methods of supplying water on dry ranges.
- 4) The production of crops on arid land that may be used for winter feeding of sheep.

Good results have already been obtained as regards the first problem, wool and mutton production having already been improved.

In 1914, a flock of Corriedale sheep were imported from New Zealand to serve as a foundation flock at the Dubois Station. The fleeces from their offspring now average about 10 lb. with a shrinkage of about 50 %. Much progress has been made in adapting these sheep to the ranges of the Western States of the Union.

Ewes of the Rambouillet breed were crossed with rams of the long-wool breeds including Lincoln, Cotswold, Leicester and Komney-Marsh. After a few years experience with these rams the best Lincoln-Rambouillet rams were mated with the best ewes of the same cross and the progeny of this cross have received the name of Columbia.

Columbia lambs weigh 10 to 12 lb heavier at weaning time than Corriedales. Columbia sheep on the whole are noted for size, mutton conformation and strong constitution. The choicest offspring resulting from the mating of Corriedale rams and Lincoln-Rambouillet ewes have been selected for the Corriedale-Columbia cross. The offspring from this combination are superior to the Corriedale in size, conformation and constitution. The Government will continue this work in the hope of breeding a type superior to either the Corriedale or the Columbia. All these cross-bred types have the flocking instinct and are well adapted to range conditions.

On the 28 000 acre ranch near Dubois, 5 fields of 80 acres each and one of 320 acres have been fenced and are being studied as to carrying capacity and for comparison of grazing under fence versus open range conditions. These fields are reseeded and furnish much more feed than unfenced ranges.

Sunflower silage is said to be an excellent winter feed for sheep.

At the Vienna Station (Virginia) Dr. Cooper CURTIS has found that it is possible to rear a fine flock of sheep in districts infested with stomach worms if the sheep are drenched once a month with a bluestone solution. A 24 % solution is prepared and kept in tightly-stoppered bottles. When required for use, it is diluted with 20 times its volume of water. Three and a half ounces of the diluted solution are given to each sheep weighing

90 lb. or more, lambs of 40 lb. can be given 1 oz. and for each additional 10 lb of live weight,  $\frac{1}{2}$  oz. should be added. This treatment must be discontinued 2 weeks before lambing.

In 1919, experiments were made in crossing American female goats with pure-bred Saanen and Toggenburg males. The best native goats only give 1  $\frac{1}{2}$  lb. of milk daily but first cross goats gave on an average 3.15 lb a day. After 2 years, the animals gave 3.9 lb. per head per day and the lactation period lasted about 9 months. F. D.

## PIGS

296 — **Sorghum as a Pig Food.** — POULAIN, A in *Journal d'Agriculture pratique*, Vol. II, No 47, p 138. Paris, November 26, 1921.

As the result of experiments made at the piggery of the Experiment Centre of Fontmarie (Bouches-du-Rhône), the author arrived at the following conclusions.

*Physiological effects.* — Judging from the excrement, sorghum is one of the most cooling foods. It has the rare virtue of permitting the systematic use of peanut cake and the forcing of development without undue strain on the organism.

*Feeding sows.* — After trying various mixtures of sorghum, wheat bran and peanut cake, the author adopted the following: sorghum 66 % + bran 22 % + peanut cake 12 %, fed in the proportion of 2 % of the weight of the animals and supplemented by a grass ration of the same weight.

Nursing-sows receive an extra meal varying according to the number and age of the litter. With these rations the average weight at birth of the young pigs in a litter of 10 is 1 300 kg. in the case of hybrid sows (Marseillais Large White Yorkshires), the average weight usually being 1,200 kg. The conditions are evidently favourable for lactic secretion and the growth of the piglings, since litters of 7 or more weigh on an average 7 kg. at the age of 1 month.

*Feeding of young pigs.* — 1) Before weaning, little pigs living in the open do best on a mixture of 70 % sorghum + 30 % sharps. They will eat it from the third week; and a litter fed with this mixture will weigh 14 to 17 kg. at the end of 60 days with a graduated ration of 0 to 600 gm. per day (0 at the beginning and 600 at the end when they are weaned) only limited by the appetite of the piglings.

2) *After weaning.* The transition period is bridged over without any danger to the animals if peanut cake is added in the proportion of 20 % of the weight of the sorghum.

A daily ration of 1200 gm of sorghum + 400 gm bran + 300 gr. peanut cake fed to animals weighing 40 kg. has increased their weight 410 gm to 500 gm. per day in the case of breeding animals of the pure Marseillais race or crossed with Large Whites. The rations were given 3 times a day and the pigs were turned out into a yard for exercise after each meal.

From these experiments it may be gathered that sorghum mixed with peanut cake in the proportion of 4 : 1 can be substituted advantageously for palm-oil cake. This mixture added to sharps seems to be one

of the best in the climate of Southern France for rearing pigs, until the fattening period.

F. D.

297 - **Suggestions with a View to the better Notation of the Shape of the Silkworm Cocoon and of Its Variations.** - PIGORINI, I. (R. Stazione Bacologica Sperimentale di Padova), in *Informazioni seriche*, Vol VIII, No 22, pp 333-334, fig. 3 Rome, November 20, 1921

SERICULTURE

The author in the course of his crossing experiments begun in 1919, found it necessary for the better notation of the shape of the cocoon to substitute for the description and the absolute figures giving the dimensions, the transverse diameter in the case of the cylindrical, ovoid, and spherical cocoons and the measures of the diameter of the inflations and of the constrictions in the constricted forms, these measures being always expressed in hundredth parts of the long diameter.

In continuing his researches, the author realised that this notation, or "characteristic", was also insufficient, as it fails to indicate whether a cocoon is spherical or cylindrical in its median portion, the greater or less distance of the inflations from the poles in constricted cocoons, etc.

The author proposes to continue to express the longitudinal diameter by 100 and to mark off (in hundredths of the longitudinal axis), the transverse diameters at given distances on the long axis. This second measure is expressed by a factor having as its numerator a figure giving the decimal division on which is marked the transverse diameter, whereas the denominator gives the value of this diameter. In the case of symmetrical cocoons, 5 notations are made, at 10-20-30-40-50 centimeters respectively of the longitudinal axis; in that of asymmetrical cocoons, 10 notations are made, one at every 10 centimeters of the longitudinal axis.

In order to make these determinations, it is necessary to project the magnified image of these cocoons upon a screen and from this image which is outlined in pencil, the measurements are taken. In this manner the author obtained for 2 commercial crosses, the data given in the following Table.

*Transverse Diameters of the Cocoons of Two Commercial Crosses*

Position of the transverse diameter on the longitudinal diameter	Gold Chinese	Yellow native	Cross Chinese Gold x Yellow native	White Chinese	Semi- spherical native	Cross white Chinese x Semi- spherical native
10	46.4	38.6	39.6	45.8	46.8	41.7
100						
20	50.3	48.2	51.0	59.2	59.6	54.8
100						
30	66.0	50.8	55.3	66.6	65.6	61.3
100						
40	69.0	49.5	56.3	70.0	68.1	63.8
100						
50	70.2	48.8	54.9	70.8	68.6	61.0
100						

These data show that in the cross Gold Chinese  $\times$  Yellow native, the cocoons are intermediate in shape between the those of the parents, whereas in the cross White Chinese  $\times$  semi-spherical native, the cocoon tends towards a new type in which the transverse diameters are reduced as compared with the longitudinal diameter and constriction makes its appearance.

F. D.

298 - A Simple Method of Obtaining Several Generations of Silkworms in the Same Year (1). — DE ZULUITA, A, in *Boletín del Museo Pedagógico de Ciencias naturales*, Vol I, No. 6, pp. 1-2, fig 1 Barcelona, March 1921

The author has succeeded in rearing 4 generations of strong silkworms by the adoption of the Japanese method which consists in getting the moths to deposit their eggs on paper and immersing both paper and eggs (4 to 5 hours after the eggs are laid), for 5 seconds in water at 55° C (2). The eggs are then allowed to dry and kept in a warmish room.

The caterpillars hatch out at the end of 12 to 15 days. In this way the author obtained a 4th generation in December.

In the August rearings (2nd generation), care must be taken to keep the surroundings damp, in order to prevent the young mulberry leaves withering too quickly.

To obtain leaves for the 3rd generation it is necessary to prune the mulberry-trees a month before the young caterpillars hatch out, a plentiful supply of fresh leaves being thus obtained. Artificial heating is needed for rearing the 4th generation and the temperature must be kept at about 20° C.

F. D.

299 - Crossing Experiments with Varieties of Silkworm Having Bivoltine Males, in Italy. — FIGORINI, L. (Direttore della R. Stazione bacologica sperimentale di Padova), in *Nuovi Annali del Ministro per l'Agricoltura*, Year I, No 1, pp 133-146 Rome, 1921

This paper is a continuation of the author's previous article entitled Crossing Experiments with Varieties of Silkworms having Bivoltine Females (3). As in the preceding case, the object of the author was not to arrive at general conclusions, but rather patiently to collect the materials that are the fruits of observations made with the greatest care and hence of undoubted value, and capable some day of forming the basis of researches undertaken to determine the laws governing the phenomena of hybridisation in *Bombyx mori*.

At the same time that the author was making his crosses the previous year with female bivoltines and annual males, he carried out reci-

(1) See. *Boletín de la Real Sociedad Española de Historia natural*, Vol XX, p. 300, and "Tomo del Cincuentario" of the same Society, pp 495-501

(2) It is even better to plunge the paper with the eggs first into warm water (54° C), then into cold (20° C) water, then repeat this process. Duration of each immersion 2-5 seconds. (Author's notes)

(3) See R. Sept. 1920, No 900 (Fd)

procal crosses with the same lots of cocoons ("Gran Sasso" and White Bivoltin excepted) viz. :

Golden Chinese female with greenish-white male bivoltine.

White Japanese female with bivoltine males, viz. greenish-white, with gibbous caterpillars, white Chinese, mixed white, yellow

Ascoli female with male bivoltines : white with gibbous caterpillars, white Chinese, mixed white, yellow.

In all 12 crosses. The caterpillars had been hatched the previous spring.

The new characters of the cocoons were the object of these researches viz. :

The size and shape, taking the total of the 780 cocoons resulting from the crosses

The colour, determined on 5 gms. of the outer silk and fibrin per cross.

The weight of the outer silk and fibrin, determined on 480 cocoons

Length of reelable silk and standard, determined on 390 spun cocoons.

Strength and elasticity, determined on the silk of 195 cocoons (1264 determinations),

Three out of the 9 characters studied behaved in the same manner in the two sets of crosses (bivoltine female  $\times$  annual male and the reciprocal crosses), while 6 behaved differently in both cases. If we add to these characters that of bivoltism, which persisted in the first case, but was lost in the second, it is evident that by transposing the males and the females in the crosses, very dissimilar products are obtained, since most of the characters behaved differently in the two cases.

The size of the cocoons and the amount of crude fibrin in the raw silk were characters behaving in a similar manner in both kinds of crosses, being intermediate and attaining the average. On the other hand, two other characters that were linked with them in the female bivoltine crosses were separate in the male bivoltine crosses. One of these is shape, which had attained the average in the preceding crosses, only deviating from it in the direction of the shape of the strangled parent independently of its sex. Thus the character "strangled" is the dominant. The other is the standard; this is considerably higher than the calculated average and shows a distinct inclination to approach that of the annual females. There were two intermediate characters, but they were below the average and inclined to the maternal character observed in the female bivoltine crosses viz., the weight of the outer silk, and the length of the reelable silk. Neither can be classed in the same manner in the present crosses. It is true they remained intermediate and different from the average; in one of them, however, the weight of the outer silk still inclines towards the maternal character, but has risen a little above the average, whereas the in other, the length of the reelable silk has fallen below it, but shows an inclination towards the paternal character. As the length of the reelable silk was less in bivoltine than in annual silkworms, it must be concluded that this character has been affected by the bivoltine parent in the crosses.

The author found that in female bivoltine crosses one character, the strength of the silk, was intermediate, deviating from the average, being higher and showing a tendency towards the paternal character.

In the male bivoltine crosses strength of silk remained intermediate and above the average, but since the greatest degree of strength is a character distinguishing annual breeds to which the females belonged in these experiments, it may safely be said that it is the annual breeds with their "stronger tenacity" that have been dominant in determining the strength of silk of the hybrids. The elasticity remained such as it was in the female bivoltine crosses viz., a non-intermediate character greater than in the case of either parent.

The question of colour is more complex. In the female bivoltine crosses the colour was not determined from the external appearance of the cocoons, but by extracting and estimating the colouring matter. It did not prove to be an intermediate character, but one with higher value than that of the paternal and maternal cocoons; these taking the total of the cases studied, attained 84 % of the sum of the parents' characters. Also in the present case this character was not intermediate; contrary to what occurred before, the average figure of all the observations was below that of the male bivoltines. On examining the phenomenon more in detail, the author found that when the annual breed produced males, the hybrid cocoons contained more colouring matter and when it produced females there was less colouring matter present.

To sum up. Whether bivoltine females were crossed with annual males, or bivoltine males with annual females was a matter of indifference as regards certain characters (size of cocoons, amount of fibrin in the raw silk), but not as regards others. In the first case, the two parents have the same effect upon the hybrids. In the second, either the sex of one of the parents exercised a special influence (weight of outer silk tending towards that of the females), or a new character has found its way into the offspring and dominated the opposite character, such as constriction in crosses between annual females and a bivoltine male, or else one breed imposed its character on the other, for instance, the length of the reelable silk has been increased by the bivoltine parent and the strength of the silk by the annual parent. In the case of elasticity, crossing on one occasion clearly shewed the determining factor conferring upon the character of the hybrids a higher value than that of the parents. Finally, a mixture of sex influence: the monovoltism and bivoltism of the two breeds crossed determined the special behaviour of the colouring matter. All these facts lead to the following modification of the schedule at the end of the preceding article.

#### A. — INTERMEDIATE CHARACTERS

##### a) *Attaining the average*

Size of cocoons.

Percentage of crude fibrin in the raw silk.

##### ax) *Sometimes attaining the average, sometimes inclining towards a special character in one of the parents, or one of the breeds:*

Shape.

Standard



b) *Deviating from the average :*

b<sub>1</sub>) *Below or above the average and tending towards a maternal character*  
Weight of outer silk

b<sub>2</sub>) *Below the average and inclining towards the breed, but with less pronounced character :*  
Length of reelable silk

b<sub>3</sub>) *Above the average and inclining towards the breed, but with more pronounced character :*  
Strength of thread

B. — NON INTERMEDIATE CHARACTERS.

a) *Superior to the characters of either of the parents*  
Elasticity of thread.

b) *Superior or inferior to the characters of the parents, and at the same time, associated with the monovoltinism or bivoltinism of the breeds crossed and with the determining sex*  
Colour

F. D.

300 — **Connection between the Hour of Gathering of Mulberry Leaves and the Silk Yield of *Bombyx mori*.** — SACCHI, R. (Laboratorio di Bachicoltura del R. Istituto Superiore Agrario di Perugia), in *Le Stazioni sperimentali agrarie italiane*, Vol. I, IV, Parts 7-10, pp. 316-325. Modena, 1921.

In preceding experiments the author had found that silkworms fed on leaves picked in the evening instead of at day-break, produced a greater weight of cocoons per ounce of eggs and a larger quantity of silk on reeling (1). He has continued his studies and supplemented them by analytic researches on the chemical composition of mulberry leaves picked at sunrise and sunset, and gives the results in the report analysed.

The data obtained confirm the statement that feeding silkworms (yellow Ascoli) with mulberry leaves gathered at sunset rather than at dawn, increases the weight of the cocoons; in one experiment 3.225 kg. of cocoons per gm. of silkworm eggs was obtained as against 3.025 kg.; and in another 2.640 kg. as against 2 kg.) The cocoons were larger and more uniform, and the silk layer was thicker; 15.66 % as against 15.39 % in one experiment; 17.6 % as against 16.8 % in another. These cocoons also produced moths that laid a larger quantity of eggs; average weight of one laying 0.478 gm., as compared with 0.426 gm..

These results depend on the fact that leaves gathered at sunset are more nutritious than those picked earlier in the day, as they contain more sugar, starch, dextrin, fats and proteins. The larger the number of days of full sunshine during the rearing of the silkworms, the more advantage is derived from giving them mulberry leaves picked at the close of the day.

F. D.

301 — **The Italian Sheep-Dog.** — MARCENARO, A. M., in *Bassa Corte*, Year II, Parts 47-48, pp. 965-986, Molassana (Genoa), December 1921.

VARIOUS  
ANIMALS

These are two varieties of sheep-dog in Italy; the Alpine and the Maremma.

The Alpine sheep-dog or "Cravino" of Bergamo greatly resembles in its general characters the French dog of la Brie, and performs the same services as the "bouvier" dog. It is a strongly-made, tall animal (about

(1) See *R. May* 1919, No. 629. (Ed.)

60 cm. in height), with thick neck, prominent withers, solid haunches, broad thorax and strong limbs; its coat is long and curly, and variable in colour: whitish, black with spots, hazel-brown, dead-leaf brown. It would be well to select the darkest, most intense and finest colour.

The Maremma or Abruzzi dogs belong to the same bred according to the author although more agile and lighter, owing to the adaptation to local conditions that is of general occurrence in all mountain breeds.

The Maremma sheep-dog is over 60 cm. in height (at the withers it is 65 cm.). Its coat is woolly, pure white and glossy. It has a well-developed frame, and strong body with shortish, strong legs; its feet are round and close, with very hard pads. As it has broad, strong haunches, it would make an excellent draught-animal, but is never so used.

Hitherto, the sheep-dog has not been systematically bred in Italy (except for private use) nor has it been the object of selection.

A "Circolo per i cani da pastore italiani" (Society for Breeding Italian Sheep-Dogs), has therefore been founded at Genoa under the auspices of the "R. Comizio agrario".

F. D.

302 - **Breeding Fur-Bearing Animals in Canada in 1920** (1). — COATS, R. H. (Dominion Statistician), in *Canada Dominion Bureau of Statistics, Fur Branch*, 23 pp. Ottawa, 1921.

In 1920 there were 587 breeding establishments in Canada. Foxes were bred at 578 of these, martens at 6, muskrats at 2 and Karakul lambs at 1. In this list are included not only establishments solely devoted to breeding, but also farms where the raising of fur-producing animals is carried on at the same time as ordinary agricultural work. On December 31, 1920, the value of the fur animals in captivity was 4 722 905 dollars, most of this sum viz. 4 536 417 dollars being represented by the silver foxes.

The total value of fur animals sold by the breeders in 1920 was 763 221 dollars, of which 750 123 dollars were paid for silver foxes, 12 913 dollars for cross foxes and 185 dollars for other species. By estimating the average sale-price at each establishment it is found that the price of a silver fox varies between 100 and 1100 dollars. In 1920, 11 000 fur animals were born in captivity, 1618 died and 2322 were killed — the number of pelts sold during the same time was 2 470; the skins brought in 388 335 dollars; of this sum 373 140 dollars were paid for silver fox skins alone, each of which fetched from 75 to 750 dollars. At the end of 1920, the fur-breeding establishments were worth 5 925 496 dollars; the value of the land and buildings being estimated at 1 202 591 dollars, and of the animals in captivity at 4 722 905 dollars. The distribution of this industry in the various provinces is as follows as regards number of establishments: Prince Edward Island 309 — Nova Scotia 55 — Quebec 80 — New Brunswick 57 — Ontario 42 — Manitoba 2 — Saskatchewan 2 — Alberta 15 — British Columbia 11 — Yukon 14 — Total 587.

G. A. B.

(1) See *R. August 1921*, No. 846 (Ed.)

303 - **Horse-Chestnuts as a Food for Rabbits.** — LAMBERT, C., in *La Revue Avicole*, Year 32, No. 1, pp. 16-17. Paris, January 1, 1922.

The author found that the rabbits on his farm at Marville-les-Bois (Eure-et-Loire), would eat horse-chestnuts, provided the bitter principle was removed by boiling. The horse-chestnuts are passed through a root-cutter adjusted to give a light cut and they are then boiled in salt water and the resulting mass is crushed. This paste is fed sprinkled over with wheat bran. The horse-chestnuts are boiled every two days. This feed is supplemented with dry hay, broom and sliced beets.

The chestnuts have to be dried as soon as they are collected, so that they may be kept in heaps but at the same time free from damage by mould. Once this ration is fed it must be continued and not given in turn with any other food. F. D.

## FARM ENGINEERING.

304 - **Condition of Motor-Cultivation in Germany.** — I. MARTINY, *Der Stand des Motorflugwesens*, in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, No. 27, pp. 301-304, No. 26, pp. 405-409. Berlin, June 18, and 25, 1921. — II. COLSMAN, *Der Stand des Motorflugwesens*, *Ibidem*, No. 27, pp. 420-422, July 2, 1921. — III. CLEVEL-GRABHOFF, *Der Stand des Motorflugwesens*, *Ibidem*, No. 27, pp. 422-423. — IV. KAUL W., *Der Stand des Motorflugwesens*, *Ibidem*, No. 27, pp. 423-425.

AGRICULTURAL  
MACHINERY

I. — The author reports on the large number of agricultural machines and implements that have accumulated at the factories, and asks how this stock can be turned to account. Customers have been deterred from purchasing by the hope that prices will fall which however in his opinion, is not likely to occur.

He considers that about half the owners of mechanical cultivation machines are dissatisfied with them; this is due to the fact that the farmer does not understand his machine and the driver has not had the necessary mechanical training. Another cause of dissatisfaction is to be found in the poor quality of the oil. The owner also complains that he does not get the returns he expected, and that the engine is not sufficiently powerful. The author makes a comparative study of the apparatus for motor-cultivation, first contrasting the work of a plough with that of a mechanical rotary.

Among the machines using mould-boards for tilling the ground, he mentions the STOCK motor-plough, the HANSA-LLOYD tractor, the W. D. and the Ergomobil machines working on the same principle as the steam-plough.

The author also speaks of some of the latest tilling machines such as VOGELER's motor-plough, KOSTO's tractor with a single driving-wheel, the BENZ tractor, the FREUND motor-plough, the DEUTZ tractor, PODEUS's caterpillar tractors. The following machines also have new features: the BUSSARD motor-plough, the LANZ tractor, the EULM tractor, the VIVAG machine, the RICHTER tractor etc.

The manufacture of light tractors is a matter of great economic im-

portance; two have already been turned out; the RÜTGER tractor and the KÖRTING motor-plough.

The position of the mechanical cultivation industry is a very difficult one and is still further threatened by the possible introduction of American machines, especially the FORD tractor.

The only means of improving the situation would be an agreement between the manufacturers of machines of the same type.

II. — The author mentions the unsatisfactory results often obtained with mechanical cultivation. The chief cause of these failures is the lack of good drivers. In order to obtain well-trained men, it is necessary to offer them payment comparing favourably with town wages and to make them feel at home in the country by providing them with a comfortable house, a small plot of ground etc.

The author is very anxious that the German Agricultural Society should experiment in the mechanical tilling of the subsoil and in breaking up the stubble by means of flexible apparatus.

III. — The author describes the working of the HANSA LLOYD tractor, provided with a 25 H.P. engine, on his own estate of 350 hectares.

*Ploughing*: with 3 or 4-furrow ploughs, 2 to 3 hectares per 10 hour day.

*Breaking up stubble*: with 9-furrow-plough and a harrow, 4.5 to 7 hectares.

*Preliminary work in the spring*: 10 hectares per day. For ploughing the fuel consumption is estimated at 28 kg. per hectare, 1 ½ kg. of lubricating oil being used per day.

The saving effected by the use of a tractor is greater, the longer the machine is used. The author trusts that the working expenses will be reduced as soon as possible, but hopes this end will be attained by tractors constructed in the country such as LANG'S light tractor.

IV. — CLEVE-GRAUHOFF describes his own experiences with the STOCK motor-plough (old and new type), the VOGELER motor-plough, the HANSA-LLOYD tractor, and the FODEUS caterpillar tractor. He emphasizes the necessity for constructing light machines. G. B.

305 — **American and German Agricultural Machines.** — BILAU, K. in *Deutsche Landwirtschaftliche Presse*, No. 13, p. 88, Berlin, February 11, 1921.

In view of the possible introduction into Germany of light American tractors, the author examines the two following questions.

1) Would the introduction of a cheap light tractor be detrimental to the German mechanical industry?

The purchaser enquires before buying a plough, how much work it can accomplish, how long it will last and its net cost. Tractors are now the fashion whether this preference can be justified or not.

The fundamental difference between tractors of foreign construction and those made in Germany is that they are lighter and develop a lower H. P. At the English Meeting of 1919, 81.15 % of the tractors were

machines of between 20 and 30 H. P. The German tractors are both more powerful and heavier, as is shown by the Table appended to the article.

If powerful machines work more economically, it must not be forgotten that the German tractors are more expensive to buy.

A start has now been made in Germany with the manufacture of lighter tractors.

2. — In what way is it possible to protect German trade from this danger? In the first place by making lighter and also cheaper machines, with at the same time an increase in the return. G. B

306 — **The Construction and Use of Agricultural Tractors in Italy.** — I. IOPARDI, R., in *La Macchina nell' Agricoltura*, Year 1, No 10, pp. 6-8 Milan, December 1921

The author considers that one of the chief reasons why agricultural tractors are little used in Italy, is that all the machines on the market are of nearly the same power, the engine developing about 25 HP, and the attachment bolt 15 H P, whereas in the different districts and various conditions of agriculture in the country, the average motor power required is between 25 and 60 HP.

This mistake is due to the fact that the manufactures have been influenced by statistics of construction in the United States, where according to the data collected by the "Federazione italiana dei Consorzi agrari" of Piacenza (*Il problema della motocultura e la trattrice agricola Fiat*), 80 % of the tractors constructed develop 12 to 24 H P, 14 %, 24 to 40 H P, and 6 % over 40 H P. Too little attention has been paid to the fact that the soils of Italy differ very greatly in character from those of North America and that the plough therefore needs more traction force. In recent years also fewer 25 HP. types have been constructed in the United States, while a larger number of the more powerful tractors have been turned out.

In order to determine the minimum force required, it is necessary to take into consideration 1) economy of labour, 2) rapidity of work, 3) the average soil resistance

1) In practice one man is not sufficient to manage a tractor, two normally being required in order to save undue loss of time in the event of unavoidable accidents. The two men in charge of a tractor receive the same wages as three peasants doing the same work with a team of animals. The saving of labour thus begins in the case of a tractor from the moment it can draw a two-share or three-share-plough for deep ploughing, or a four-share or five-share-plough for superficial cultivation.

2) In order to do the work at the right time, it must be possible to execute it quickly; the most useful speed for tractors is reckoned at 3.6 km. per hour.

3) From experiments carried out in Italy (at Melegnano, Lodi, etc.), the following data have been obtained as regards soil resistance: in deep ploughing, from 60 to 70 kg. per sq. dm. of the cut; in superficial ploughing from 40 to 50 kg. per sq. dm. From these data it is possible

to calculate the minimum force required from a tractor for the various cultural operations.

Allowing for: a speed of 3.6 km. per hour (1 metre per second), a depth of 70 cm. for deep ploughing and 20 cm. in the case of superficial ploughing and a cut 30 cm. in width for each share, we should have the following cases:

A. -- For deep ploughing:

a) with one-share tractor: cutting 9 sq. dm.; power necessary at attachment bolt  $9 \times 70 \times 1 = 630$  kilogram-seconds.

b) with 2 share tractor: cutting 18 sq. dm.; power necessary at attachment bolt  $18 \times 70 \times 1 = 1260$  kgm-sec.

c) with 3 share tractor: cutting 27 sq. dm.; power necessary at attachment bolt = 1890 kgm-sec.

B. -- For superficial ploughing: d) with 2 share tractor: cutting 18 sq. dm.; power necessary at attachment bolt  $18 \times 50 \times 1 = 900$  kgm-sec.

e) with 4 share tractor: cutting 24 sq. dm.; power necessary at attachment bolt  $24 \times 50 \times 1 = 1200$  kgm-sec.

f) with 5 share tractor 30 sq. dm. power necessary at attachment bolt  $30 \times 50 \times 1 = 1500$  kgm-sec.

It is necessary to provide a little extra power to meet unexpected increases in resistance. If these are allowed for by increasing by  $\frac{1}{4}$  the powers given above, the figures become respectively: 790 — 1580 — 2370 — 1125 — 1500 — 1875 kgm-sec.

With the best types of ordinary tractors, the average output would hardly exceed 50 %. Hence the engines generating the above-named powers should develop:

a) 1500 kgm-sec. or 21 HP

b) 3160 " " " 2 "

c) 7170 " " " 63 "

d) 2250 kgm-sec. or 30 HP

e) 3000 " " " 40 "

f) 3750 " " " 50 "

If to avoid a too heavy machine a one-share tractor only is used, it is at once seen, from what has already been said, that there ought to be at least 3 types of tractor on the market, of respectively: 15 to 25 H P; 17 to 35 H P; 22 to 45 H P.

The necessity of having at least these 3 types in order to satisfy the demand and requirements of different farmers depends on the fact that these tractors are also used for another important purpose, viz., to work the threshing-machines often coupled with forage presses. In order to work these machines the following powers are necessary:

0.75 Thresher with Press 15-18 HP.

0.61 " " " 18-20 "

1.07 " " " 23-25 "

1.22 " " " 26-30 "

1.37 " " " 30-36 "

Ploughing to a depth of 40-45 cm., could always be done with a one-share tractor without giving up all the advantages afforded by an agricultural tractor.

F. D.

*Landw. Presse*, No 17, pp 122-123 Berlin, March 2, 1921

**portant :**

**Weight of the machine . . . . .kg**

*pratique*, Year 80, Vol. I No. 1, pp. 78-80, figs. 3; Paris, Jan. 28, 1922.

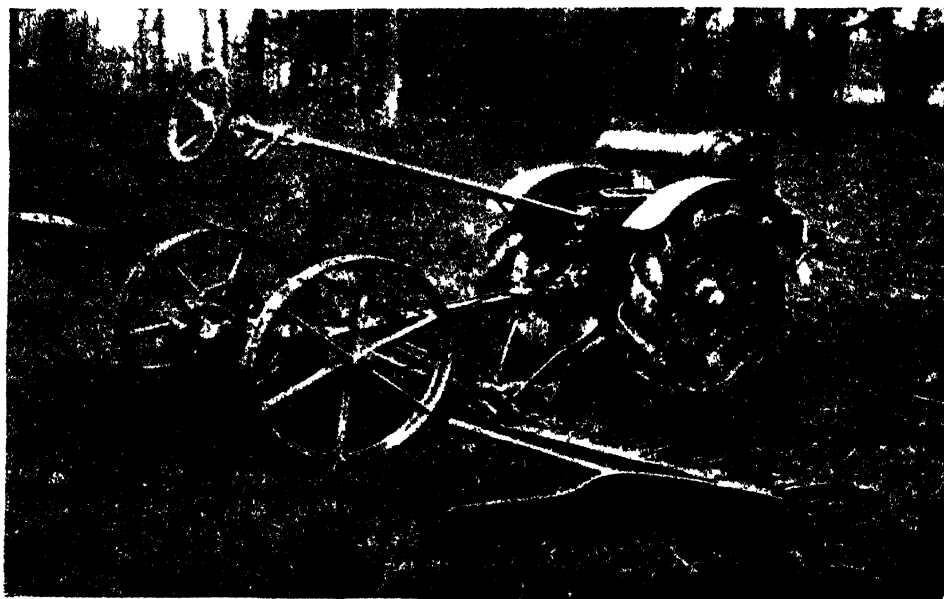
work.

machines by means of a belt.

(1) See R. Oct.-Dec. 1919, No. 1222 I. p. 1273. R. March 1920, No. 354. (*Ld*)

with slanting protections ; they work conjointly with the axle or separately and independently of it, acting on handles attached to the centre of each wheel which uncouple the tractor, or cause it to go forwards or backwards by adjustments in the pawl-boxes of the nave. There is no speed-gear, and the turning radius is very small the turning being carried out on one wheel.

To this fore-carriage are attached various agricultural machines provided with a seat from which the driver can work the unrevolvable steering-wheel at the side of which are two handles one for the carburettor, and the other for uncoupling.



Fore carriage Tractor « Agro » attached to a reaper

The total weight of the fore-carriage tractor is about 850 kg, its external width of 1.08 m allows it to be used in vineyards, especially as it can turn on a very small radius.

To the fore carriage can be attached, according to the work to be done, a one two or three furrow two way plough. The attachment of a single two-way plough for harrow ploughing is an easy matter.

To the back of the fore-carriage is affixed an attachment system for different agricultural machines. In the case of reapers or harvester-binders, the pole is replaced by a very short beam of which the front portion is shod with iron.

The working speed varies from 3000 to 4500 m per hour. According to information supplied, the following work could be done per hour.



ploughing to a depth of 0.25 m. : 10 *ares* — ordinary ploughing from 0.18 m. to 0.20 m. : 15 *ares* — breaking up stubble from 0.10 m. to 0.12 m. : 25 *ares* — with cultivator with flexible teeth : 30-50 *ares* — reaper and harvester-binder : 35-40 *ares*.

The hourly consumption of fuel would vary with the character of the work from 2.5 to 3 litres of petrol to which must be added 5 to 6 % of lubricating oil.

Several machines can be belt-driven even if the engine is left on its frame in the fore-carriage tractor, but it can easily be detached being kept in place by 4 bolts only, and put in any required position, in communication with a supply of petrol.

G. B.

309 - **Power of the Engines of Tractors.** — PASSALEGUE, G., in *Journal d'Agriculture pratique*, Vol. 36, No 36, pp 212-214 Paris, September 12, 1921

The numerous tests made of the engines of tractors at the Paris Machine Trial Station show that the maximum power obtained at the pulley is only  $\frac{8}{10}$  of the force developed by the machine at the test-bench. Therefore, before purchasing a tractor it is well to consider its actual hauling power rather than the engine's record at the testing Station.

G. B.

310 - **Wedging a Tractor.** — RINGELMANN, M., in *Journal d'Agriculture pratique*, Vol. 1, No 12, pp 234-236 Paris, March 16, 1921

The author mentions several ways of wedging a tractor working as a stationary machine. Of these the following method adopted in America is the most interesting. A piece of wood is applied to the outside of the tires of the wheels on either side. The wood is placed obliquely against the wheel of the largest diameter, it skirts the second wheel, and is buttressed on the ground. The beam is affixed to the tires by means of braces.

G. B.

311 - **Rear-driven Tractors.** — RINGELMANN, M., in *Journal d'Agriculture pratique*, Vol 1, No 14, pp 275-276 Paris, April 9, 1921.

The author states the conditions to be fulfilled by a tractor in order that it may be driven from the rear, that is to say, from a seat on the machine towed by the tractor.

- 1) The engine must be provided with an automatic speed regulator.
- 2) Coupling and uncoupling must be effected by a rope if required.
- 3) It must be possible to prolong the steering shaft backwards.

G. B.

312 - **A Charcoal Gas-Engine for Tractors** (1). — GREILSAMMER, in *Journal d'Agriculture pratique*, Year 85, No 41, pp 318-319, 1 fig Paris, October 15, 1921

In the course of a public demonstration of Mechanical Cultivation given by the Association of Stockbreeders and Agriculturists of Indre,

(1) See *R* Jan 1922, No 95 Other experiments with tractors running on poor gas and burning charcoal have been carried out by the Agricultural Co-operative Society of Berry (Department of Indre). The tractor, provided with a gas-engine, towed a 3-furrow plough

on September 23 and 24, 1921, the CAZES gas-engine, type D L, was tested at Châteauroux. This engine, which developed 30 to 40 HP, was mounted on a TOURAND-LATIL tractor with a 35 HP, 4 cylinder, petrol engine (of 0.105 m. bore, and 0.140 m. stroke at 1200 revolutions per minute).

The gas-engine and purifying apparatus are mounted on a platform at the back of the tractor.

The gas-engine consists of a sheet-iron cylinder with a non-conducting lining and a bottom without a grating having an opening in its circumference through which the steam is admitted. The boiler producing the steam is situated in the upper part and works on the principle of immediate steam generation, independently of the slope of the ground. The water feeding the apparatus flows through and falls drop by drop from a small copper pipe upon a grating pierced with holes that covers the boiler.

The steam thus produced passes through a cooler at the side of the gas-engine where it cools the heated gases that are travelling in the reverse direction. Then the steam at once finds its way to the bottom of the gas-engine.

The gases after passing through the cooler go through the scrubber, which is formed of a column of coke.

A fine rain falls upon the coke from a spiral cooler in the upper part of the scrubber which is supplied with water from the tank above.

On leaving the scrubber, the cooled and purified gases pass into a chamber where they come into contact with a number of U-shaped vertical pieces of iron upon which they condense, depositing droplets of water and small particles of tar. The gases are then conducted into a box containing horse-hair, wadding or other absorbent material, where they are finally purified and freed from the last particles of tar. Thence the gases pass into a mixer acting as a carburettor, where the required amount of air is added.

This mixer consists of a cylindrical chamber with an opening of varying size which is regulated by the displacement of a circular jacket. The air is drawn in through this aperture and mixes with the gas entering through a throttle-valve by which its flow is regulated.

The amount of gas and of air is controlled by two regulators worked by handles placed near the hand of the driver. This mixer, which is of very simple construction, works admirably and is less delicate than an ordinary carburettor.

The whole plant is completed by a ventilator worked by a handle (supplying the gas-engine with the air required for combustion and ignition), and by a funnel placed before the cooler and above the exit-pipe for the gases coming from the gas-engine.

on heavy soil Depth of ploughing 15 cm consumption per hectare. charcoal 45 kg water 50 litres. As the charcoal was bought at 0.22 fr per kg. the cost of the fuel used was 9.90 fr. per hectare — G. PASSELEGUE, "Tracteurs à gaz pauvre", in *Journal d'Agriculture pratique*, Vol. 36, No 39, p. 279. Paris, Oct. 1, 1921. (Ed.)

A tank with a capacity of 80-100 litres distributes the water to the scrubber and the gas-engine by means of regulating tap.

The gas-engine with its accessories takes up comparatively little space, the whole apparatus is about 1.55 m. high, 1.50 m. wide and 0.50 m. long; thus its volume is not much over 1 cubic metre.

The total weight of these engines is about 500 kg., and could be reduced to 400 kg. by decreasing the weight of the fire-proof clay lining.

The size of the CAZES gas-engine allows it to be used for all existing tractors, but it would have to be considerably reduced to adapt it for machines of about 20 HP.

The author's statements may be summarised as follows.

The maximum consumption, when ploughing with a 3-furrow plough to a depth of 0.15 m. and a breadth of 1.05 m., is 52 kg. of charcoal and 62 litres of water per hectare.

Another tractor, the TOURAND-LATHI, which is identical but runs on petrol, drew a 4-furrow plough on the same day at the same speed, which would seem to show that the maximum loss of power in substituting poor gas for petrol would be 25 %.

Charcoal bought retail at 0.22 fr. the kg. in Châteauroux cost 11.45 fr. per hectare, as against 72 fr. paid for petrol. This represents a saving of 60 fr. per hectare, or 85 % on the fuel expenditure. F. D.

313 - **On Accidents due to Tractors.** — RINGELMANN, M., in *Journal d'Agriculture pratique*, Vol. 36, No. 29, pp. 71-73 Paris, July 23, 1921.

The author investigates the various accidents that have occurred, and advises in order to guard against mischance that the driver should tape his seat upon the machine in tow and not upon the tractor.

G. B.

314 - **The "Buckeye" Tractor Ditcher for Land Drainage. Trials in England.** — GARNER, H. V. (School of Agriculture, Cambridge), in *The Journal of the Ministry of Agriculture*, Vol. XXVII, No. 1, pp. 306-320, Tables IV, figs. 2. London, July 1921.

Report of trials with this American machine conducted at Croxton, Cambridgeshire (England), following on highly successful results in Scotland.

The "Buckeye" tractor ditcher here described is designed on the rotating wheel system and the following is an abridged specification: 20 h. p. 4-cylinder petrol engine; digging wheel 11 ½ in. or 14 ½ in. wide × 4 ½ ft. deep, or 11 ½ in. wide × 5 ½ ft. deep; length over all 25 ft.; width over wheels 8 ft. 6 in.; extreme height 8 ft. 9 in.; digging speeds 2 ½ ft. to 9 ft. per minute; road speeds 1 to 1 ½ miles per hour; approximate shipping weight 7-9 tons; width of front wheels 10 in.; width of extension tyres to front wheels 8 in.; width of caterpillar track, 22 in., centre of ditch to centre of spoil bank 4 ft. 3 in.

The chief points of the machine are as follows:— Substantial main frame and platform constructed of steel T-beams connected at intervals by crossbeams and strongly reinforced, carries at one end a 20 h. p. en-

gine unit and transmission system, and at the other the cutting wheel hinged to the platform. The frame and superstructure are supported at both ends on 3-point suspension trucks which eliminate severe twisting strains.

The digging wheel is mounted midway between the two main girders and is held in a 3-point suspension frame hinged to the main platform. Power is transmitted to the wheel by a system of chains running on sprocket wheels ; by shifting a high speed chain from one set of a series of graduated sprockets to another, 4 digging speeds ranging from 2 ½ ft. to 9 ft. per minute can be obtained. This plan is found to be very satisfactory and effective.

A feature of the transmission system is a safety device in the form of a friction cone clutch, which slips when the machine strikes an obstruction beyond its capacity, thus averting a breakdown. On the outside

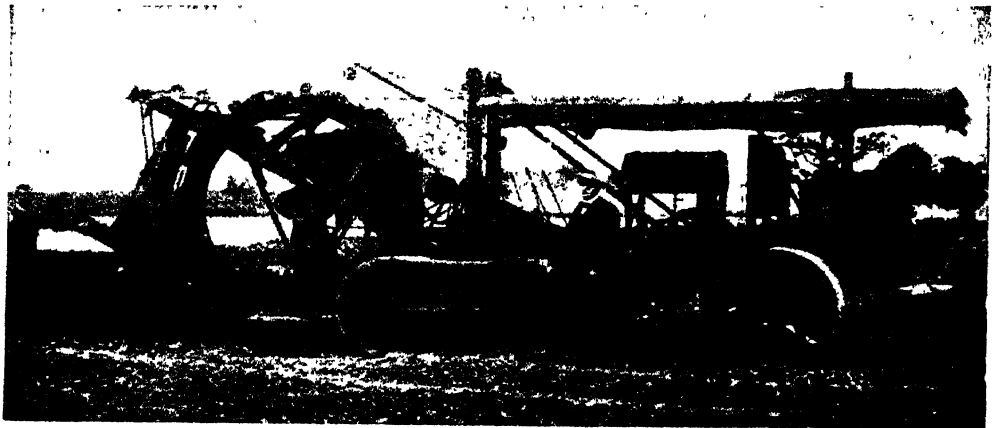


FIG. 1. — « Buckeye » Tractor. Ditcher at rest.

rim of the digging wheel are mounted buckets of deep section which can be suitably equipped for varying classes of work.

Adjustment of the depth of the digging wheel is obtained by a hoist worked from the engine and operated through a double boom, the cables communicating with both the front and the rear of the wheel frame. If the wheel is rotated and lowered, keeping the forward end of the frame some 3 ft. lower than its rear end, the buckets will dig themselves into the ground at this angle as the whole machine is advanced. At some pre-arranged depth, the descent is checked by means of the front cables ; the rear cables are then slackened, allowing the curved sole which follows the digging wheel to take the weight of the rear of the wheel and thus mould and smooth the floor of the trench.

The method of adjustment in order to obtain a drain of even fall when the machine passes over uneven land is described in detail. Follow-

ing in the appended diagram, A B C represents an irregular surface below which the drain has to be cut. At intervals of about 50yds. along this line, levels are taken in the usual way. Having decided the fall required in the drain, the depths below the surface at which the floor of the trench must lie at A, B and C are calculated. (Suppose these depths are 4 ft. 6 in., 3 ft. and 4 ft. respectively, as in the diagram where F G

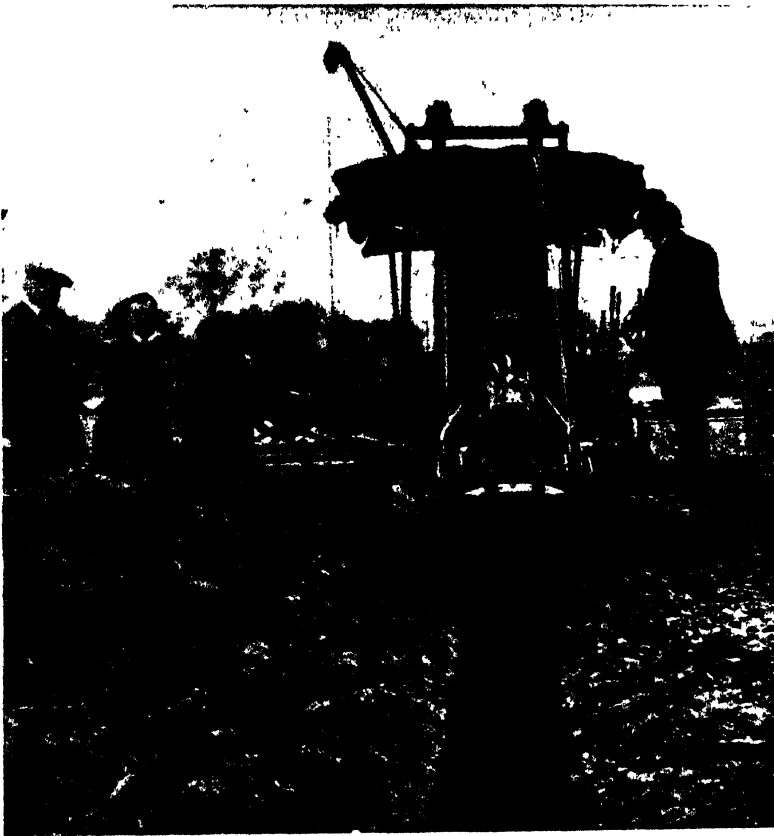


FIG. 2. — Buckeye Tractor. Ditcher at work, Back view.

represents the bottom of the drain and F H the horizontal). The movable cross members A X, B Y and C Z are adjusted in correlation with a horizontal sighting rod D fixed to the frame of the digging wheel E of the ditcher. If D is fixed 9 ft. above the level above the floor of the drain, A X, B Y and C Z must also be fixed at 9 ft. above the level at which the drain is to be dug; thus A X at point A will be 4 ft. 6 in. above ground, and B Y will measure 6 ft. above ground at B etc. The machine

is then moved to the outlet end A of the drain, since digging always proceeds uphill, and made to face along the line of standards. The digging wheel is made to cut its way into the ground; when the rod D intersects the line of cross-members, the further descent of the wheel is stopped by the winding gear. The ditcher now proceeds along the line of the proposed drain and it is important to keep the rod D constantly in alignment with the cross-members by raising or lowering the wheel E in accordance with the irregularities of the land. If this is done carefully, a trench with an even fall can be excavated in a single operation.

In describing the methods to be adopted in dealing with this machine, it is noted that two men are sufficient for the actual working. Arrangements should be made to lay the drainage pipes close behind the machine, as delay in doing so will probably result in loose earth falling into the finished excavation.

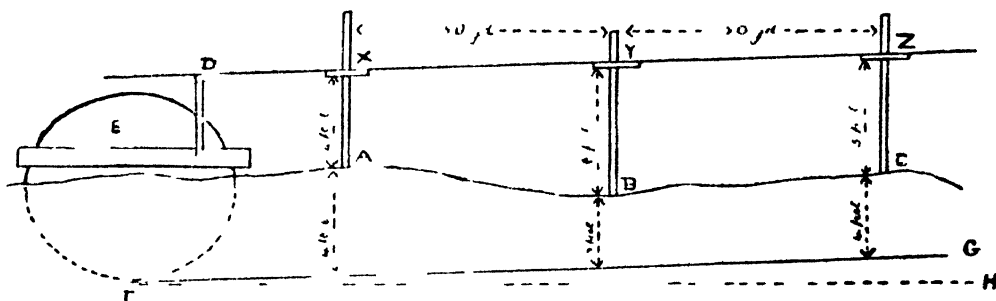


FIG 3 — Diagram shewing the method used to regulate the depth of the trench when the Ditcher passes over uneven ground.

The trials were carried out on 2 types of demonstration field:—

1) a 12-acre bare fallow of gentle and uniform slope; about 5 in. of dry friable soil on the surface with moist and sticky clay below. In the upper parts of the field, bands of chalky gravel were found in the clay.

2) wheat stubbles with hard-baked clay surfaces resting on dry clay. (The mechanical analyses of the respective subsoils is shown in tabular form).

It was subsequently found that the ditcher could operate more rapidly at any given depth in a dry clay subsoil containing chalk and gravel than in a wet clay subsoil. The machine proved itself capable of excavating straight trenches for land drainage to any depth not exceeding 4 ft 6 in. but difficulty was found in excavating trenches with a curve approximating to a right angle and under such conditions, it is considered advisable to build a catchpit at the angle of the bend.

The rate of excavation measured in chains per hour obviously increases rapidly as the trench becomes shallower, the type of soil being

the same ; the speeds vary according to depth and moisture of subsoil ; 3 ft. 6 in. drains in moist clay were dug at the rate of 1.7 chains per running hour, and in dry clay at 3.0 chains per hour ; 2 ft. drains in dry clay at 9 chains per hour. The rate of fuel consumption is roughly constant at all speeds varying from 2-2.8 gall. per hour. (The machine is fitted with an automatic cut-out, which acts like a governor and causes the engine to run at constant speed). Indications are also given showing how much work could be done under the various conditions of depth and soil if it were kept running *e. g.* for 7 hours per day. Under these conditions about 63 chains of 2 ft. minors could be dug in dry clay, 21 chains of 3 ft. 6 in. mains in similar clay or 12 chains of 3 ft. 6 in. mains in wet clay.

An attempt has been made on a conservative basis to estimate the costs of operating under commercial conditions, and they compare favourably with present costs of hand digging ; the calculation is shown as follows :—

2ft. 6in. branches	in moist stiff clay where 1.7 chains were excavated per hour				
	cost 20s. 11d. per chain				
2ft. 6in. "	similar clay	cost	10s. 2d	per chain	
3ft. 7in. "	dry clay	"	11s. 11d	"	"
2ft. 9in. "	dry clay	"	7s. 9d	"	"
2ft. "	dry clay	"	4s. 0d	"	"

It is noted that hand drainage is done at an average rate of 2 chains of 2 ft. 6 in trench per day of 8 hours compared with Buckeye drainage in about 20 minutes.

The trial showed that the friction produced by the revolution of the digging wheel in moist clay greatly retarded the speed of work and raised the cost, but by fixing scrapers to the framework and adjusting them to remove the adherent clay from the sides of the wheel, much of the friction could be obviated. By fitting the drainer with a wheel and buckets capable of digging trenches 11 in. as a maximum and 8 in. as a minimum, instead of 14 ½ in. maximum and 11 ½ in. minimum, considerable economy of cost of operating might be expected.

The machine is not suitable for purchase by farmers unless operating on a very large scale ; it is suitable for use by agricultural contractors or by landowners with large estates.

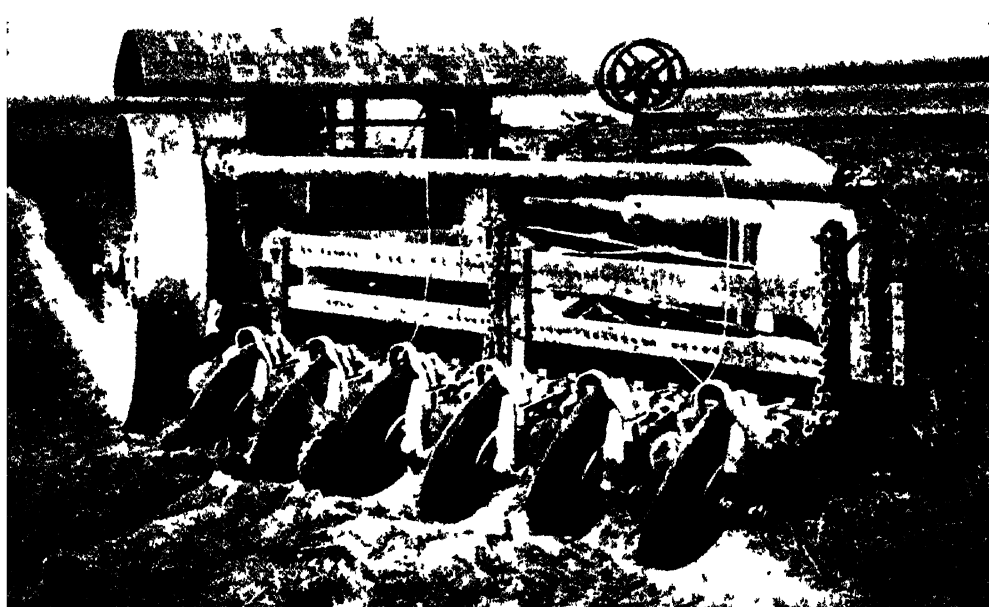
M. L. Y.

315 - **Motor-Plough for Ploughing on the Flat.** — DESSAISAIK, R., in *Journal d'Agriculture pratique*, Vol. 36, No. 38, p. 253. Paris, September 24, 1921.

Description of the Tournesol disk-plough with reverse or shuttle-action.

This machine consists of a central portion including the engine with its accessories, as well as the driving-wheels, and of two symmetrical parts placed at each end, one of which works only when the machine is reversed and the parts of the other are removed from the soil. At the end of each furrow, the function of each working portion is reversed.

The central part includes the engine which sets in motion 3 driving-wheels, one on the side of the furrow, and two land-wheels, of slightly smaller diameter. These two wheels or one of them (the other remaining fixed) can be slanted by the steering-handles, which are each worked from one of the two seats successively occupied by the driver.



Tournesol Motor Plough: back view

The engine is said to develop 30 HP ; it makes 1100 revolutions a minute, and has 4 vertical cylinders of 0 100 m. bore. The pistons have a stroke of 0 160 m. In continuous work this engine can develop 37.16 HP. It has two speeds ; one of about 2500 and the other of about 4 000 m. per hour. Total weight of motor-plough : about 4 000 kg.

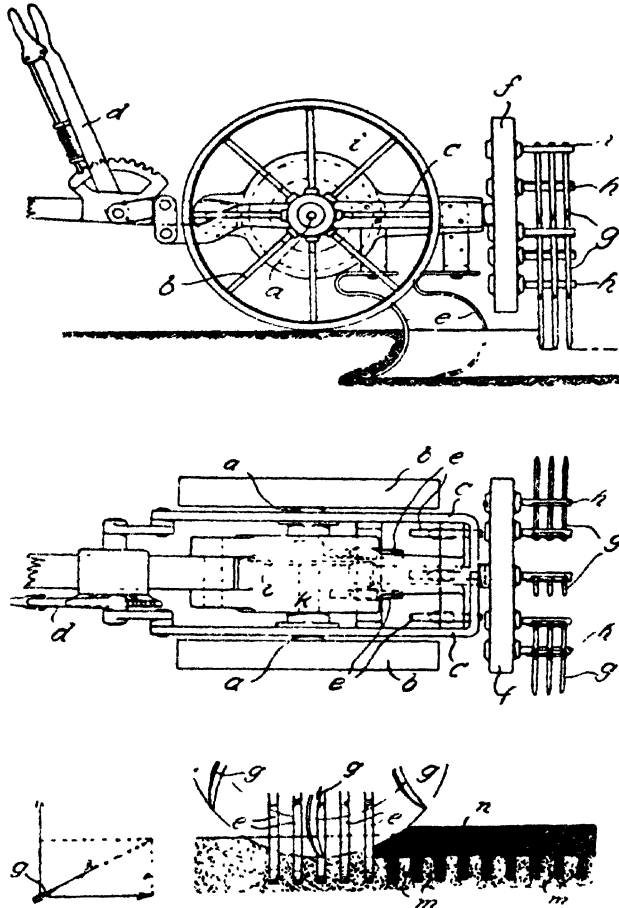
In the model represented in the figure, the working parts consist of mould-boards with disks mounted on either side on two frames that are raised at the end of the furrow by coupling the engine on a slanting tube acting as a windlass, around which are rolled the elevating cables. If the soil is very heavy and the ploughing deep, 3 disks may be used in place of 6.

Manufactured by : Société Delahaye, 10 Rue du Banquier, Paris.  
G. B.



316 - **New Machine with Flexible Teeth and Rotating Forks.** — *Deutsche Landwirtschaftliche Presse*, No. 5, p. 33, Berlin, Jan. 19, 1921.

The manufacturer having noticed that experiments in loosening the soil have proved that it is not always necessary to turn over the earth as is usually done, has devised a new apparatus of which figures are given. It consists of a frame upon which are mounted the flexible teeth of a cultivator. These make a series of furrows, the loosening of the soil being subsequently effected by a system of forks similar to those attached to a potato-digger.



G. B.

317 - **Choice of Machines based on Spring Awakening of Arable Land.** — See No. 235 of this Review.

318 - **Pantzier Machine for Chopping and Distributing Manure.** — *Deutsche Landw. Presse*, No. 15, p. 100, Berlin, February 25, 1921.

This apparatus consists of a hopper in the form of a barrel mounted on 4 wheels. The interior of the hopper is covered with blades between

which pass other blades attached to a shaft, the movement of these blades setting the wheels in motion. On leaving the hopper, the manure passes into a funnel fitted with other blades that complete the work. It is distributed by means of a horizontal disk with a rapid rotary motion. G. B.

319 - **The Decortication of Beet Seed.** — RINGELMANN, M., in *Journal d'Agriculture pratique*, Vol. 1, No. 11, pp. 214-216. Paris, March 19, 1921.

The author discusses the advantages derived from decorticating beet-root seeds in such a manner as to set free the seeds contained in the glomeres, and describes the mechanical means to be adopted for the purpose.

As a result of experiments in hulling the different varieties of rice from Central Africa, Madagascar and Indo-China, he was led to try the same machines for the decortication of certain seeds (those of the beet, sainfoin, sulla and carrot) which are difficult to sow or reluctant to germinate. He found that the small model of the Neptune crusher (Messrs. PILTER, Nevers), when properly regulated to 38 revolutions per minute, decorticated 5 kg. of Tunisian sulla and 6 kg. of Egyptian sulla per hour, these seeds being much harder to hull than carrot or beet seeds.

Another trial was made with the "Melchior" rice huller of the General Millstone-Makers' Society of Ferté-sous-Jouarre, Seine-et-Marne. The working part of the machine consists of a truncated cone with a vertical axis, the whole surface being covered with perforated sheet-iron. The fly-wheel fitted inside with 147 teeth, engages with a pinion of 27 teeth mounted on a small horizontal axis having at the end two angle wheels, which set in motion the vertical axis of the truncated cone (the decorticator). With a speed of 38 revolutions of the fly-wheel, 18 kg. of Tunisian sulla seed and 15 kg. of Egyptian sulla seed are decorticated per hour.

With these two machines from 7000 to 7300 kilogrammetres are needed for decorticating 1 kg. of sulla. G. B.

320 - **Haupt Potato-Planter with Cylindrical Hopper.** — *Deutsche Landwirtschaftliche Presse*, No. 11, p. 75, Berlin, February 9, 1921.

The drum containing the tubers for planting has on its circumference 8 openings corresponding to pointed funnels. The funnels when they come to the upper part of the cylinder, fall inwards from their own weight, and receive the potato. When they reach the bottom however they leave the drum, and the potato falls into the furrow. G. B.

321 - **Motor-Mowers.** — PASSELEGUE, G., in *Journal d'Agriculture pratique*, Vol. 35, No. 2, pp. 31-36. Paris, January 13, 1921.

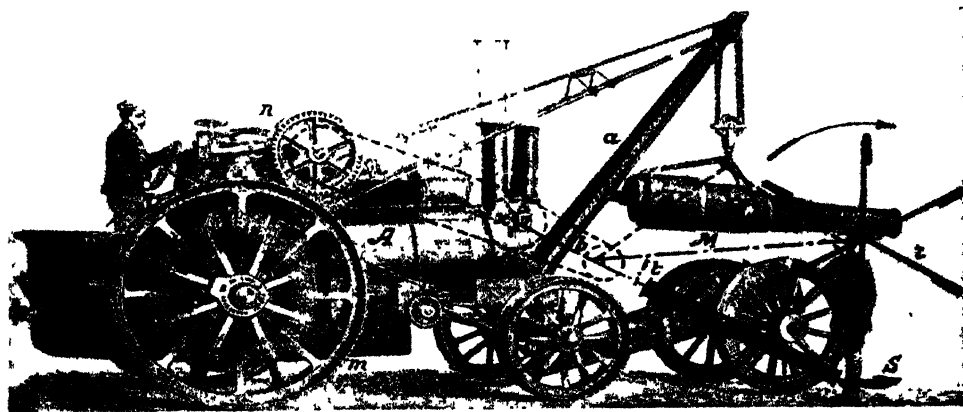
The author gives a description of the VALLOTTON and the FORD types of motor-mowers and refers to the results obtained in 1914 by RINGELMANN with the VALLOTTON mower.

Nature of Field	One year old Lucerne	Natural meadow
Average width of swathe. . . . .	1.04 m.	1.14 m.
Time taken to mow 1 hectare . . . . .	4 hrs 30 min.	3 hrs 15 min.
Petrol consumed per hectare . . . . .	4.85 kg.	4.56 kg.

322 - **Reaper-Binder for Tractor.** — RINGELMANN, M., in *Journal d'Agriculture pratique*, Vol. 36, No. 27, pp. 32-35. Paris, July 9, 1921.

The author discusses the question of the preliminary circuit of the field, and with the AVELING and PORTER steam-reaper which renders the operation unnecessary in mind, suggests that a tractor could be attached to the reaper-binder.

In this reaper, which was shown at the Universal Exhibition at Paris in 1878), the engine carried the jib of a crane *a* (see appended figure), and a windlass that could be coupled when required with the engine *n*; in front was a reaper, *M*., supported by the crane *a* which allowed the height of the stroke to be regulated. The reaper and the crane were connected with the engine *A* by two shafts *b* whose rotation axis *x* coincided with the transmission axis worked by a GALL chain. At the end of the machine, when it was necessary to turn, the mechanic raised the reaper *M* by engaging the windlass of the crane *a*.



The AVELING and PORTER Reaper-binder.

The AVELING and PORTER mounting with the crane jib and windlass can be used with advantage if a reaper-binder of the present type is attached to the fore-end of a tractor. The movement would be transmitted from the engine to the different parts of the reaper-binder by means of chains. G. B.

323 - **Stooker for Large Threshing-Machine.** — SOURISSEAU, I. H., in *Journal d'Agriculture pratique*, Vol. 25, No. 16, pp. 311-316. Paris, April 23, 1921

This elevator (constructed by the Society of the "Olive" Stookers, 32, Rue de Metz, Toulouse), works like a straw-stacker. It consists mainly of a carrier with chains mounted on the thresher.

The frame supporting the platform of the elevator is enabled, by means of a handwinch, to rise to the top of the rick and follow its level progressively as far as the ground.

The apparatus turns round a vertical axis and it can be pushed into any given position, so as to take sheaves on the right or left of the threshers. For purposes of transport the apparatus can be folded and arranged on the platform in such a manner as to take up less room. It is possible to combine the elevator with an automatic hopper.

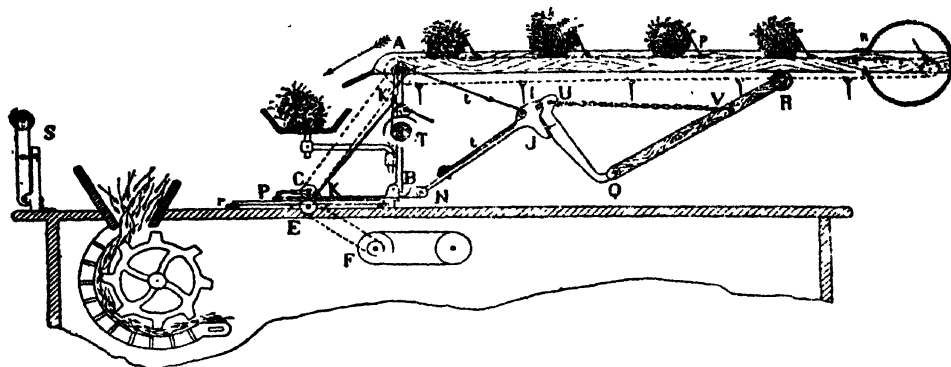


Fig. 1. — Elevator with automatic hopper, side view.

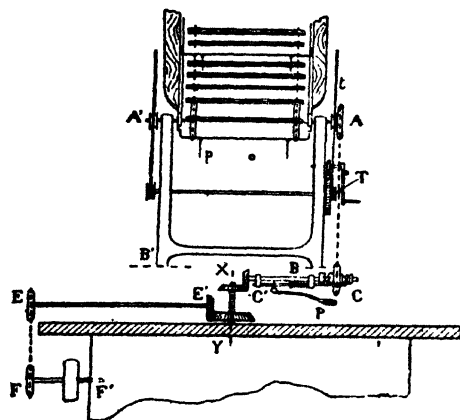


Fig. 2. — Stooker, end view.

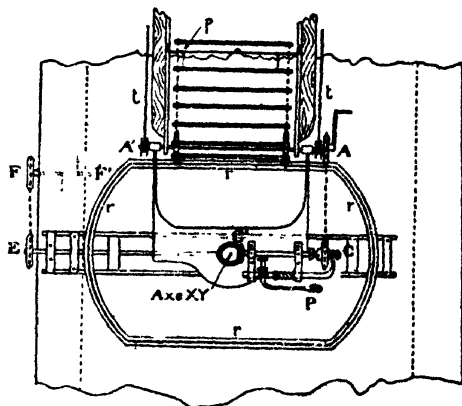


Fig. 3. — Stooker, plan.

**TRANSMISSION OF THE MOVEMENT TO THE PLATFORM.** — The platform is formed of two ledges fixed on two chains with detachable links passing over two cog-wheels, placed at either end of a wooden frame in the form of a ladder which is articulated with the shaft *AA* (figs. 1, 2 and 3). This shaft which transmits the motion to the platform is supported by a frame articulated at *BB*. This frame is kept vertical by the detachable props *KK'*. The shaft *AA* is governed by the transmission *AC, CC', XY, EE', FF'*. In order to catch the sheaves, the ledges are provided with points

*P*, kept in the position shown in the figure by means of an erg sliding into a groove at *U*. On the right of the shaft *AA*, the erg leaves the groove in *U*, its points become loose, and the sheaf falls into the cradle. Then the worker cuts the rope and throws the sheaf into the threshing machine, or automatic thresher.

A coupling device with claws is affixed to the shaft *CC'*. A pedal *P* which the worker can depress with his foot disengages it instantly.

**RAISING AND LOWERING THE PLATFORM.** — The frame supporting the platform is articulated with *AA*, it rests on a roller *R* which is kept in place by a system of pivoted levers *NI*, *IQ*, *QR*. The levers *IQ* and *QR* are connected by a chain *UV* with a shock-absorber hook and spring. The system *IQR* articulated with *I* rests on the erg, *J*.

A steel cable rolled on the drum *T* of a winch which is fixed on the vertical shaft *AB*, allows the platform carrying the sheaves to be raised or lowered with the raising or depressing of the lever *NJ* about the pivot *N*. A protecting hoop is fixed at the end of the trough.

**ORIENTATION OF THE APPARATUS.** — The elevator is mounted on a kind of turning-plate resting on a rail *r* (fig. 3) and turning about the axis *XY*. In whatever direction the apparatus is turned, the motion is transmitted by conical pinions.

**FOLDING THE APPARATUS FOR TRANSPORT OF THE THRESHER AND SETTING FOR WORK.** — The operations to be performed are as follows. Turn the apparatus through 180° from the position it occupies in fig. 1. Lower the platform until the two uprights of the frame rest on the supporting roller *S*, fixed at the end of the thresher. Raise the roller *R*. The steel cable *t* being no longer stretched is unhooked and the lever *QR* folded back on the lever *QI*. The vertical frame *AB*, is folded forward after unpinning the props at *K'*. The apparatus now rests on the turning-plate and the rail, the stacker being on the top. The machine is set up by reversing the above operations.

**TESTS.** — The author has tested this elevator upon a large threshing-machine with a beater 1.22 m. long and a platform 4.80 m. from the ground. The frame carrying the platform of the elevator measured 4.80 m.; the end of the frame could sink to the level of the ground, and rise to a height of 5.70 m.

The transmissions were arranged so as to make the platform travel 0.70 m. per second. The output has been estimated several times at 30 sheaves per minute. When working normally the machine uses on an average  $\frac{1}{2}$  HP.

G. B.

324 — **The Laskowski Apparatus for Preventing Accidents during Threshing.** — *Deutsche Landwirt. Presse*, No. 15, p. 106, Berlin, February 25, 1921.

This apparatus consists of a metal frame of suitable height separating the thresher from the feeding-hopper; a grating protects him from falling grain.

G. B.

325 - **Carrying the Harvest on a Light Road Tractor.** — LIERMAN, M., in *Journal d'Agriculture pratique*, Vol. 36, No. 52, pp. 528-529. Paris, December 31, 1921.

The author gives the results obtained in transporting the harvest 1 km. by means of a light tractor towing 4 trucks which saves 20 % of the cost of using horses and carts. A saving of perhaps 40 % might be effected if 5 trucks were employed and the transport distance were limited to 1 km. or less. G. B.

326 - **The Guidetti and Piazza Cellar Presses.** — CASTELLI U., in *La Macchina nell'Agricoltura*, Year 1, No. 10, pp. 9-11, figs. 4, Milan, December 1921.

The author describes two types of cellar presses of Italian manufacture which were commended at the "Esposizioni Romane riunite" held at Forlì towards the end of 1921.

Messrs GUIDETTI and Co. of Reggio Emilia make several kinds of hydraulic cellar presses with hand-pump.

The "GUIMOR" type shown in fig. 1 has 2 cylinders with a conical axis; the larger cylinder which is under the basin, exerting the pressure and the smaller carrying out the return movement, both motions being produced by the help of a single hand-pump with two concentric pistons (for high and low pressure) and an intermediate tap with 3 screws.

This press is made in 4 sizes with a capacity of 400-500-668-808 litres respectively, the diameter of the basin being 0.80-0.90-1.00-1.10 m. and its height 0.80-0.80-0.85-0.85 m. The pressure exerted in order to obtain in the cage a pressure of about 9 kg. per sq. cm., varies from 170 to 250 atmospheres, or nearly double the pressure obtained with presses furnished with ordinary screws, in which case the ratio between the diameter of the screw and that of the cage would be 1 : 10.

Another press made by the same firm, the "B type", has one pressure cylinder, the cage and plate slide on a frame that rises against a fixed socket placed above it and supported by architraves and 2 columns, which is an arrangement similar to that customary in ordinary oil-presses. The return movement is produced by the weight of the movable part. Dimensions: diameter 1 m.; height of cage 0.85 m.; capacity 668 litres; pressure 12 kg. per sq. cm., works under a pressure of 285 atmospheres.

The same Firm also makes presses with 2 or 4 rolling vats or reving vats.

Figure 2 shows the "Torchio continuo per mosti e vinacce" or continuous press for musts and pomace, of PIAZZA Bros. of Ravenna. In these vats pressure is applied by means of a single screw with horizontal axis, turning in a cylindrical cage and pushing forward the pomace that has been exhausted in the upper hopper, driving it towards the exit where the opening of the cage is circumscribed by a conical stopper provided with a pressurespring that can be regulated. The push and counter-push being transmitted to the axis of the screw, neutralise one another. A special contrivance prevents the contents being carried along by the rotatory motion. The machine is completed by apparatus for feeding, and transmission by fixed or free pulleys and if necessary by a frame and rammer. It can press 60 quintals of grapes in an hour.

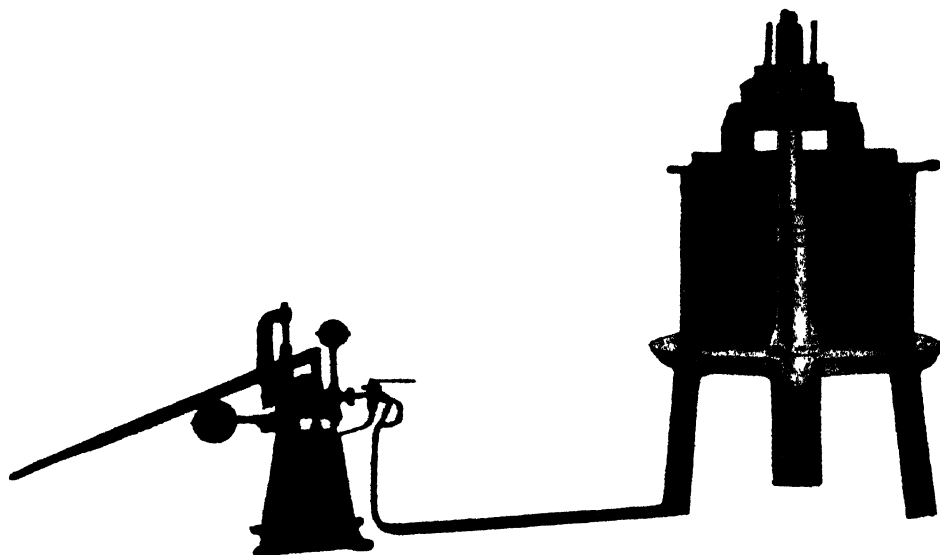


Figure 1 — GUIMOR Press

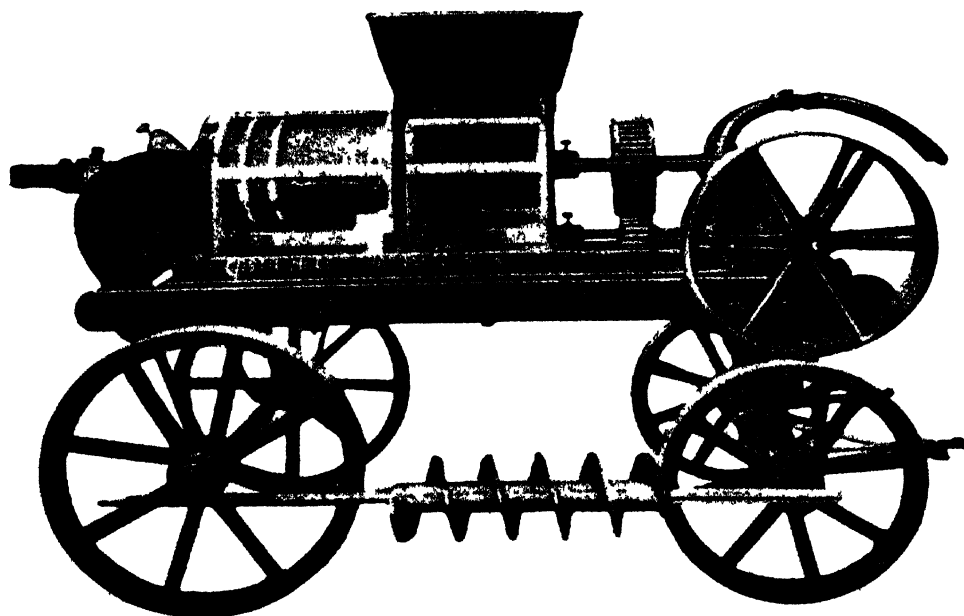


Figure 2 — PIAZZA Press

F D

[310]

327 - **On the Choice of a Pump.** — RINGELMANN, M., in *Journal d'Agriculture pratique*, Vol. 36, No. 30, p. 91. Paris, July 30, 1921

The author after calculating the water requirements of an agricultural farm during the various seasons of the year, describes the different engines that can be used to work the pumps.

For every plant this choice depends upon the type of engine, the water raised per second, and the total height to which the water has to be raised. Of the pumps that fulfil the required conditions, the one that works best and costs least for installation and maintenance should be chosen. The mechanical output, although important, ought not to play a preponderant part in deciding the choice of a pump. G. B.

328 - **A Deep Suction Pump.** — *Deutsche Landwirtschaftliche Presse*, No. 1, pp. 34 Berlin, January 5, 1921

With this special type of pump the usual depth of suction, which is practically 6 to 7 m., is raised to over 20 m. The pumping-engines are installed on the surface of the ground and the deep suction apparatus is sunk below the water-table G. B.

329 - **The Work of Teams** (1). — RINGELMANN, M., Travail utilisable des attelages, in *Journal d'Agriculture pratique*, Vol. 36, No. 47, p. 420 Paris, November 26, 1921 — II IDEM, Prix de revient de la journée de travail d'un cheval. *Ibidem*, No. 48, p. 451. December 3, 1921. — III IDEM Travail utilisé des attelages, *Ibidem*, No. 49, pp. 472-473 December 10, 1921 — IV IDEM, Repartition du travail des attelages, *Ibidem*, No. 52, pp. 529-531. December 31, 1921

I. — It has been found that under normal conditions the field-work of teams lasts at least 3 hours less than the time intervening between sunrise and sunset. The author gives a graphic curve showing the actual monthly work of ploughing-teams, using as his basis the astronomical and meteorological data available.

II — Taking into account the feeding, annual depreciation, shoeing, harness, interest on capital outlay and veterinary expenses, the author, basing his calculation on 275 work-days, reckons the cost of the team at 16.55 fr. per day without counting the expense of the driver.

III — The author, basing his statements on notes taken in 1911, 1912, and 1913, at a farm in the South-west of the Department of Oise, divides the work of draught animals under its different heads. In the 2 busiest months (March and October) out of 100 working days, 32.5 and 28.1 are respectively devoted to ploughing, and 30.6 and 47 to carting.

Further the number of days when the animals are actually used, is less than the possible number; there being as a rule a deficit of 30 % charged on the general farming expenses.

IV. — The author continues his examination of these data. He shows that for various reasons it is impossible to turn to full account the draught animals on a farm, and determines for the case considered, the number which are unused most of the time and could with advantage be replaced by mechanical motor power. G. B.

(1) See R. April 1921, No. 424 III. (Ed.)



330 - **Dynamometers.** — I. DESSAISIAUX, A., Dynamomètre pour Tracteurs, in *Journal d'Agriculture pratique*, Vol. 35, No. 25, p. 492, fig. 1. Paris, June 25, 1921. — II. MANRIN, G., Dynamomètre de rotation pour essai de machines agricoles, *Ibidem*, Vol. 36, No. 31, pp. 171-176. August 27, 1921.

I. — Description of an indicator with maxima needle.

II. — Description of the rotatory dynamometer used in testing agricultural machines. Calculations are made based on the degree of deformation of the springs.

G. B.

## AGRICULTURAL INDUSTRIES

331 - **Investigations on Potato Storage during the Hot Season in Western India.** — MANN, H. H., and NAGPURKAR, S. D., in *Investigations on Potato Cultivation in Western India*, Bulletin No. 102 (of 1920), Department of Agriculture, Bombay, 1921.

STORAGE  
OF CROPS

The "heat rot" or "black heart" of potato has led to loss of germinating power and rendered potatoes useless for seed to a very large extent in Western India. The elimination of this form of rot in stored potatoes is a matter of serious importance at the present time. The authors here describe the best systems so far adopted.

Apart from actual diseases present in tubers, there appears to be no risk in storing at any temperature below 86° F and little danger below 90° F provided that there is sufficient aeration among the stored tubers. The period of danger is between early March and the end of May, or later when the monsoon rains are delayed. During this period the following method has proved distinctly advantageous: —

A shallow pit (usually 10 ft. long, 5 ft. wide and 18 in. deep) is dug under the shade of a tree or under a roof; this is filled with water which is allowed to soak away and the space to dry for 5 days.

The sorted potatoes are then heaped upon it, generally to a depth of 3 to 3 ½ ft. but sometimes as deep as 4 to 5 ft. and covered with a thick layer of grass or broad leaves. The temperature is kept down by occasionally filling a ditch dug round the pit with water and sprinkling the heap of potatoes. In such heaps the temperature has risen to 92 or 93° F but no higher. If the shade is considerable, the temperature does not rise to the same extent and in some cases has not exceeded 86° F.

Other cultivators have stored potatoes in substantially built store houses, usually in heaps from 2-3 ft. thick, and seed potatoes are turned and sorted frequently. The temperature in these heaps varied from 86 to 93° F.

It is considered likely that when the process of fumigation of potatoes becomes general and it is possible to reduce the damage done by the potato moth (*Phthorimea operculella*), these two methods will prove distinctly advantageous. Up till now, storage in bags has been found essential, in order to protect the fumigated seed from reinfection by moth. It has been shown that this caterpillar is an important means of spreading various rots, especially dry rot (*Fusarium*). A specially built storage house has been designed to protect against moth infection from outside and also

against high temperature and the resulting heat-rot. The plan of the building is as follows:— Double walls on all sides with air-space between; wire gauze over windows and door-space; roof of tiles, but underneath a ceiling covered with earth to a depth of 4 in.; ceiling open all round the edge and pierced by several openings in the centre; chimney to allow continual draught during hot weather; holes in floor connected with outside air by means of drain pipes partially filled with water; skeleton shelves to allow two layers of bags to be stored without in any way interfering with the aeration of either layer.

The store-room so built has been a distinct success in Poona and has to a large extent prevented rotting. The windows are kept open from 8 p. m. to 6 a. m. in the hot weather and then closed. The temperature has been kept as low as 82° F, when the temperature outside has risen to 101° F in the shade.

As a result of experiments made in various districts the following system appears to be advantageous. Within a week or 10 days of harvesting, the stock contained in bags should be fumigated with petrol vapour and subjected to selection for ring disease, dry rot, etc. The potatoes should then be re-bagged and if possible stored in a specially made house as described above. In the absence of special arrangements for a free draught of air, the open doors should be hung with canvas curtains kept moist during the hotter parts of the day.

M. L. Y.

332 - **Changes occurring in Oranges in the Course of Preservation.** - ANDRÉ, G., in *Comptes rendus de l'Académie des Sciences*, t. 173, No. 25, pp. 1399-1401. Paris, Dec. 19, 1921.

The author's experiments were made in the following manner. The oranges were divided into two groups of which one was subjected to analysis at once, while the other was superficially sterilised and preserved for 23 to 72 days in a sterilised vessel containing a small quantity of water and sealed with cottonwool. One sample was preserved in *vacuo*.

The respiratory strength of the oranges at ordinary temperature was measured by putting three whole fruits under a bell-glass in which a measured current of air circulated, this after its passage over the oranges traversing a solution of potash contained in two REISER tubes.

The results of the experiment showed that during preservation the process of ripening takes place in such a way that there is a marked diminution of acidity with a slight loss of sugar content. However, as these effects are also to be noted in *vacuo*, the diminution in acidity cannot be wholly attributable to oxidation but must partly be ascribed to a decomposition of a diastatic nature.

F. D.

333 - **Causes of Inferiority of Manila Hemp Fibres (*Musa Textilis*) in recent Consignments.** - *Bulletin of the Imperial Institute*, Vol. XIX, No. 2, pp. 127-132. London, 1921.

Attention was drawn recently by a firm of fibre merchants to the fact that certain consignments of Manila hemp received in the United Kingdom had been found very deficient in strength. Samples of the defective

fibre were forwarded to the Imperial Intitute for examination and the results of the investigation are here described

Examination showed that the damage caused was due to a degradation of the cellulose, doubtless of bacterial origin, promoted by prolonged storage in a moist condition at a tropical temperature. This was confirmed by the fact that, on placing the fibre under similar conditions in the laboratory, the cellulose underwent further degradation and the fibre simultaneously increased in weakness. The fact that the storage of Manila hemp in a moist condition causes serious injury to the fibre is well-known in the Philippines, where hemp is most successfully cultivated, the rainfall is abundant and the bundles of wet fibre are packed indoors with the result that immense quantities of inferior fibre flood the market.

It is evident therefore that in order to avoid deterioration in Manila hemp, the utmost care should be exercised in drying the fibre and avoiding storage in a moist state.

Fermentation is liable to be more pronounced in the lower grades as they are not so well cleaned as fibre of the better qualities and contain more easily fermentable material in the form of parenchymatous tissue.

I, M Y

## PLANT DISEASES

### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN

334 - **Heat-rot or Black Heart in Potatoes in India.** — See No. 331. of this *Review*.

335 - **Further Researches on the Dry Gummosis of Citrus Trees** (1). — SAVASTANO I., in *R. Stazione sperimentale di Vannicoltura e Frutticoltura, Acireale, Bollettino* 12, pp. 1-6, figs. 9, Acireale, 1921

An account is here given of the results of further studies of dry gummosis, "gommosi secca" or "mal secco", of citrus-trees.

Three districts where the citrus is largely grown were visited: the lemon-groves of S. Teresa-Riva (Prov. of Messina), the orange-gardens of Biancavilla (Prov. of Catania), and the orange and lemon gardens of the peninsula of Sorrento (Naples). In the last district the disease is of long standing and has assumed a more serious character of recent years.

In the plantations examined it was found that the malady occurs sporadically, that is to say, it attacks isolated trees and usually only a few branches are affected. It rarely happens that the disease assumes an intense form as at S. Teresa-Riva.

Lemon and orange-trees are equally liable to attack.

The author is of opinion that a careful investigation would reveal the presence of the disease in places which at first sight appear immune, especially in old or neglected citrus plantations.

The disease begins from two distinct points, viz., the apices of the young shoots of the season, and the woody shoots, branches and trunk. In both cases, it spreads downwards in the same manner as ordinary gummosis.

In the green branches the disease runs its course during the spring and summer. The tip becomes bent, turns yellow and withers; frequently there is exudation of a gummy liquid. The infection spreads down the branch and ceases on reaching a certain spot. Next year there is a recrudescence of the disease, which continues to descend and penetrates into the branch upon which the infected secondary branch is situated. The leaves and spines wither, the leaves becoming detached, while the spines remain. If the course of the malady is rapid, the infection spreads

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(1) See *R.* Jan. 1922, No. 106. (*Ed.*)

the same year from the green to the woody branches, and the green branches usually wither completely.

In woody shoots, branches and trunks the disease follows the same course as ordinary gummosis, extending downwards between the bark and the wood, and the branches along its course wither. The bark retains its natural colour during the first period of the disease, so there is no sign of its presence underneath; herein dry gummosis differs from ordinary gummosis, as also in the fact that the bark does not finally become cracked but dries up and remains adherent to the wood. If a piece of the bark is removed, a gummy viscous liquid a little darker in colour than gum is found.

As the disease extends the foliage of the tree assumes a sickly aspect, and if it becomes aggravated the tree rapidly withers.

Occasionally the disease manifests itself in the form of patches, a gummy cortical spot forms round the bud which dries up. This is a localised form of gummosis.

Other fruit-trees, including those bearing stone-fruits, fruits with seed, and fig-trees, have been found in Sicily, Calabria and the Province of Naples to be attacked by a disease resembling the "mal secco" of the citrus.

This affection, according to the author, is to be attributed to the action of a bacterium, possibly *Bacterium gummi*. In California recently, *Bact. ultra-retiacens* has been found to be the cause of a disease which from its microscopic characters is undoubtedly dry gummosis.

The bacteria cannot pass from tree to tree, nor even from one branch to another without an inoculating agent; in the present case the cause of infection was the common fly which the author has often seen in the act of sucking the exudation from infected branches. At S. Teresa-Riva the trees first attacked were in the neighbourhood of a farm which was naturally infested with flies.

Grafting is a direct cause of dry gummosis; of the two commonest forms cleft-grafting is the more and shield-grafting the less dangerous, for as the disease is seated between the bark and the wood, it is easy to detect its presence with shield grafting, whereas it often passes undetected in clefts. The disease is aggravated in many ways such as: intense manuring or want of manuring, triennial, irregular dressing, excessive or unseasonable irrigation, neglect in triennial pruning and too infrequent tillage.

As regards the treatment of dry gummosis, the author advises: 1) cutting off the young branches as soon as they are found to be infected, this fulfils the double purpose of suppressing a new centre of bacteria and of preventing the further spread of the disease by insect agency, 2) the removal of the entire large branch, even if only partly withered, should the first operation have been delayed, and the removal of the branch below the diseased patch; 3) raising with a knife a small portion of the bark of the diseased shoots and branches in order to see if the wood is healthy; should it prove infected, the wood must be probed till healthy tissue is found and all the branch below this point must be cut off. If there are any small gum-coloured spots, or

patches, the branch should be cut back to the healthy part, 4) cutting below the graft, if the trunk proves to be diseased and allowing the Seville orange to grow again, after which it must be re-grafted, 5) felling and uprooting the tree, if the stock itself is contaminated. The hole must be left open and exposed to the sun. In the spring another Seville orange-tree can be planted.

G T

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

#### RESISTANT PLANTS

- 336 "Excelsior" Oats Resistant to Rust in Brazil. See No. 41 of this Review.
- 337 - Hybrid Potatoes resistant to Mildew (*Phytophthora infestans*) in France. — See No. 45 of this Review.
- 338 - Behaviour of different Varieties of Sugar Cane towards Diseases and Pests. — See No. 251 of this Review.
- 339 - Types of Sugar-Cane Native to Java, Resistant to Disease and to the Cane-Borer (*Diatraea saccharalis*). See No. 46 of this Review.
- 340 Types of North American Oats attacked by Rust, in Brazil. See No. 41 of this Review.
- 341 - "Ring Disease" (*Bacillus Solanacearum*) and Dry Rot (*Fusarium* sp.) of the Potato, in India. See No. 331 of this Review.

#### DISEASES OF VARIOUS CROPS

- 342 - Observations on *Dothidiella Ulei*, an Ascomycete Injurious to *Hevea brasiliensis* in South America. CARYL A. in *Transactions of the Royal Society of London*, Vol. LV, No. 49, pp. 17-19. (Received January 1913.)

In 1912 the author observed that the leaves of some young specimens of *Hevea brasiliensis* growing in the experiment field at Belmonte Para (Brazil), had been attacked by a cryptogamic disease. The latter was attributable, according to GRIFFON and MAUBLANC, to the Ascomycete *Dothidella Ulei* Hennings (1).

By means of later researches made, not only at Para, but also in British Guiana and Surinam this disease was proved to be of very common occurrence in South America and all the details of the complete life cycle of the parasitic fungus were discovered.

A scientific expedition made by the author in 1920 in Dutch Guiana confirmed the apprehensions already entertained as to the serious nature of the disease. The plantations of *H. brasiliensis* that had been made in this Colony are now abandoned and most of the trees have been felled, solely on account of the attacks of *Dothidella Ulei*. Even in the case of trees old enough for tapping, the leaves were so severely injured, the laminae being riddled with holes, that they were no longer able to discharge their functions. The trees are in a wretched condition and even if

(1) See R. July 1913, No. 885 (Ld.)

they do not die, are reduced to such a pitiable physiological state as to be unable to produce more than very small quantities of latex of no economic value. The rapidity with which the disease spreads varies according to the growth conditions and is greatest where the soil is damp and insufficiently drained. Badly attacked trees are however also to be found growing on healthy well-drained soils, on the highest dykes of the polders, and even on estates at a fair altitude.

The cultivation of *H. brasiliensis* has now been completely given up in Surinam.

From the information collected by the author in British Guiana it is easy to foretell that the same fate, due to the same cause, is awaiting the rubber plantations in the Colony, for in 1919 the acreage under *Hevea* had decreased to half what it had been a few years before.

*Doth. Ulei* is the pest threatening any *Hevea* plantations that may possibly be established in Brazil in the future, and as the only economic solution of the problem of obtaining Brazilian rubber consists in growing *Hevea* on the banks of the Amazon, the necessary prophylactic measures must be adopted in making any new plantations. G. T.

343 - *Vermicularia Capsici*, a Deuteromycete Injurious to *Capsicum annuum* and *C. frutescens*, in Bihar, India. — DASTUR J. F., in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. XI, No. 5, pp. 129-144, pl. 2. Calcutta, 1921.

The most serious disease of chillies (*Capsicum annuum* and *C. frutescens*), in Bihar is the die-back disease due to *Vermicularia Capsici* Syd., which causes considerable damage to the crop in years where there is continuous rain or high humidity in the latter half of September and beginning of October. In Bihar the disease first appears at the end of September or in the first half of October, when the plants are mature and have begun to flower. It spreads rapidly from one field to another and in severe cases of attack, the plants are either completely killed or so badly diseased that the yield of healthy fruits is negligible. The first nip of the cold dry weather gives a sudden check to the progress of the disease which eventually dies away; the plants then recover and put forth healthy new shoots. The critical period when the plants are subject to the attack of the disease is therefore of short duration, about four to six weeks.

Plants growing under shade have been observed to suffer very little from this disease. Late sown crops are also very little affected, but give a very poor return. Fruits that mature before the beginning of December become badly diseased, to the extent of about 35 %, but those ripening later escape the disease, the percentage of infected fruits after the middle of the month being negligible.

On the stem the attack as a rule starts from the growing point or the flower bud, and therefore the presence of the disease in the early stage of attack is marked by the withering and turning brown of the top of the affected branches. The plant dies back as the attack spreads downwards and when it reaches a fork the infection runs up the sound limb. In some

cases the attack starts, not from the growing point but from a wound on the stem. As the disease progresses, the infected part of the stem assumes an enamelled white colour and is sharply marked off from the healthy green bark by a black line running round the whitened area. The white of the diseased part is punctuated by scattered, black, bristly and minute elevations which are the acervuli of the fungus.

The fruits become visibly diseased when they turn red, but very seldom while they are still green. The first outward sign of infection is the appearance of a small black circular speck, generally sharply defined but at times diffused. The disease does not spread concentrically, but rather in the direction of the long axis of the pod, so that the originally circular spot becomes more or less elliptical. As the infection progresses, the spot is either diffused and black, greenish-black, dirty grey or is markedly delimited by a thick and sharp black outline enclosing a lighter black or straw-coloured area. Two or more diseased spots may become confluent, thereby destroying the regularity of the individual spots, but the delimiting black line is not always completely obliterated where the infected areas have united. Badly diseased pods lose their normal red colour and turn straw-coloured or in some cases pale white. The acervuli of the fungus are generally densely crowded together or else scattered; at times they are arranged concentrically. They project a little above the surface of the pod, and are bristly and carbonaceous. When a diseased pod is cut open the lower surface of the skin is found covered with minute, black, spherical elevations, which are the stromatic masses, or sclerotia of the fungus. In advanced cases the seeds are covered with a felt of white mycelium in which are embedded a few black or grey-green stromatic bodies. Infected seeds turn rusty in colour.

The author describes separately the microscopic characters of the disease on the stem, fruit, and seed and also gives an account of the cultural characters of the parasite. Cultures of the latter were inoculated with positive results on Chillies (seedlings grown in sterilised tubes containing moist plugs of cotton-wool; seeds removed aseptically from healthy pods, and growing points and flowers of plants raised in pots; mature pods and seeds); *Carica Papaya* (very young flowers and fruits), *Vigna Catjang* and *Dolichos Lablab* (fruits); *Solanum Melongena* (fruits), *Citrus* sp. The inoculation experiments showed that the plants take the infection only when the humidity is very high. If it is reduced below a certain limit, the progress of the disease is checked. Negative results were obtained by inoculations on mango (*Mangifera indica*), plantains (*Musa* sp.), French bean (*Phaseolus vulgaris*), sweet peas (*Lathyrus odorata*), onions (*Allium cepa*), sugar cane (*Saccharum officinarum*) and *Sorghum vulgare*.

It was at first supposed that seed selection would perhaps play an important part in controlling this disease, but the desired result has not been obtained under field conditions.

Experiments were also made in treating infected seeds with different strengths of copper sulphate solution and of formalin before sowing. The



rate of germination was however not higher, for it was found that the fungus hibernates in the seed.

Further experiments in controlling the disease were made in 1917, on eight plots under Chillies. From the results obtained the following deductions can be drawn: The disease appears after the end of the rains in the first and second week of October; it attacks plants only at a definite stage of their development viz, when the flowers have set, and disappears as soon as the cold weather starts in the beginning of November. Fruits maturing before the beginning of December are much damaged by the disease, but the percentage of infection on fruits that ripen later is small. It seems therefore probable that if a late-maturing variety could be successfully grown in Bihar, it would escape the disease.

As the *Vermicularia* disease is very common on varieties of Chillies grown locally, tests were made of seeds from Bombay and Peshawar, where it had not been reported, in order to see if plants raised from them were disease-resistant. Unfortunately these varieties did not grow well at Bihar.

The plants growing under the shade of trees or other crops suffer less from the attacks of *V. Capsae* and *Choanophora Cucurbitarum* (B. and Rav.) Thaxt. The latter parasite had never before been noticed on Chillies, but caused great damage. It started from the flower or leaf-bud, and led to wet rot of the shoot. Moisture plays a very important part in the development and spread of the disease, and hence plants growing under shade remain healthy while those in the open are affected. In October and November, night dews and ground fogs are heavy and the plants consequently become very wet at night and remain so for some time after sunrise; this high humidity is favourable to the spread of the disease. Under shade, however, there is very little mist or dew-fall and consequently the atmosphere is comparatively dry, or at least dry enough to check the spread of the disease. The experiments made did not yield any practical results from which the effect of shade upon the total yield and the percentage of diseased fruits can be determined.

The application of 2 cwt. superphosphate + 1 cwt. nitrate of soda per acre not only increases the total yield of fruits, but also reduces the percentage of diseased fruits. It is doubtful if the use of artificial manures is possible on account of the present inflated prices.

Two applications of 1 % Burgundy mixture are enough to control the disease, both on the plants and on the fruits. It is possible that only one application, if given at the right time, might be equally efficacious.

Healthy fruits from sprayed plants remain unspotted on drying, while those from unsprayed plants develop the disease.

Better results may be obtained by a combination of the application of manure and spraying with Burgundy mixture.

Late sown chillies suffer little from *V. capsae* and *Ch. Cucurbitarum*.

Judging from the observations of the last few years, it would appear that the die-back disease in Bihar becomes virulent when the humidity per-

centage in the second half of September (when the plants begin to flower), is on an average above 85. G. T.

344 - *Phyllosticta congesta*, a Deuteromycete Injurious to *Prunus triflora* in Georgia. — ROBERTS, J. W., in *Journal of Agricultural Research*, Vol. XXII, No. 7, pp 365-370, figs. 2, 1 plate Washington, D. C., 1921.

In June 1905, near Fort Valley (Georgia) pickings were made of fruits and leaves of the Japanese plum (*Prunus triflora* Roxbg.) which had been attacked by a disease very closely resembling the apple blotch (*Phyllosticta solitaria* F. and E.). On May 27 1908, the disease was again observed on both fruit and foliage of the Burbank plum in Georgia. It was found to be rather common in several orchards near Montezuma, and in some cases caused enough damage to injure seriously the market value of the fruit. On May 29 1917, other Japanese plum-fruits and leaves affected by the same disease were found in the same locality.

The varieties of *P. triflora* known as Abundance and Burbank were those attacked and an unnamed seedling also probably belonging to *Prunus triflora*.

The affected parts on the unripe fruit appear as dark-coloured raised areas, with fringed margins and are somewhat roughened by the presence of small blisters and depressions. As in the case of apple-blotch the skin often becomes ruptured as the fruit increases in size. On the ripe fruit the portions covered by pustules appear as irregular brown areas 3 to 6 mm. in diameter and consisting of an aggregation of 4 to 20 sunken spots, each of which is 1 mm. or less in diameter. At this stage, the spots have a peculiar light blue cast owing to the "bloom" of the ripe plum covering the brown epidermis. The diseased area is rather superficial, extending only slightly below the epidermis. The affected tissues become hardened and somewhat leathery, showing no tendency to decay. Small glistening pycnidia are produced in considerable numbers even in the younger spots. On account of its characteristic appearance on the fruit, the disease has been given the popular name of "plum-blotch".

On the upper surface of the leaf blades, the spots are angular, rather small, brown when young, but later becoming grey or silvery in colour. They may be numerous, as many as 200 sometimes appearing on a single leaf.

Usually one pycnidium only is present in each spot. Affected areas are also found on the petioles and on the veins of the lower surface of the leaf, especially on the midrib. On these the diseased areas are much larger than on the upper surface of the blade, and they are black and sunken. Pycnidia bearing spores are present in great abundance.

Pycnidia, apparently identical with those found in the fruit and leaves, were also seen in small light-coloured, often slightly sunken areas on the twigs.

The cause of plum blotch has been proved to be an organism identical with the fungus originally described by HEALD and WOLF as *Phyllosticta congesta* (1911), a parasite occurring on the leaves of the apple-tree in Texas.

In the spring of 1918, no spores were obtained in cultures, but inoculations were made by spraying the young fruits and leaves of the varieties Abundance and Burbank with bits of hyphae and sterile pycnidia suspended in sterile distilled water. The results were negative in every case. In 1919 spores obtained from apple-twig cultures and suspended in sterile distilled water were applied to the fruit, foliage and twigs of "Abundance" plums. When cultures originally obtained from plum fruits were used, two fruits both with two typical blotches, and three leaves with scattered spots were found. Each of these spots bore a single pycnidium with the characteristic stylospores of *Phyllosticta congesta*.

Like results were obtained by the use of cultures obtained from the leaves; one fruit showed three typical blotches with pycnidia and two others showed one; seven leaves were successfully infected. From all these artificially inoculated parts, the fungus was re-isolated and proved to be *P. congesta*.

No lesions were found on the twigs.

Inoculations made upon *P. triflora* with stylospores from pure cultures of *Phyllosticta solitaria* gave negative results in 1918, 1919 and 1920, although the stylospores were applied to fruit foliage, and twigs at frequent intervals throughout the spring.

No attempts to control Plum Blotch have yet been made. G. T.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

345 - *Coccidae* from the Seychelles (1). — GREEN, E. F., and LAING, F., in *Bulletin of Entomological Research*, Vol. XII, Part 2, pp. 125-128, figs. 4. London, 1921.

GENERAL

The list contains the following species of *Coccidae* collected in different parts of the Seychelles.

1) *Pseudaonidia iota*, a new species found on the upper surface of leaf of *Eugenia caryophyllata*.

2) *Ps. aldabrac* sp. n., on bark of "Bois d'Amande";

3) *Aonidia obtusa* sp. n., on *Verschaffeltia splendida*;

4) *Ceroplastes rubens* Mask., on *Acrostichum* sp. Widely distributed in the Australasian region.

5) *Chionaspis subcorticalis* Green, on tomatoes, and *Sida* sp. Hitherto recorded from Ceylon only.

6) *Pinnaspis buxi* Bouché, on *Pandanus Seychellarum*; also on *Areca catechu*, an almost cosmopolitan species.

7) *Diaspis (Aulacaspis) flacourti* Rutherf., on *Flacourtia*; this is the first time that any figures have been given for this species, which was previously known from Ceylon only, where the insect was observed to cause irregular and conspicuous swellings on the older and mature branches of its host. G. T.

(1) See also R. Jan. 1917, No. 106 (Ed.)

- 346 - A Revision of the Genus *Locusta* L. (= *Pachytylus* Fieb.), with a New Theory as to the Periodicity and Migrations of Locusts. — UVAROV, B. P., in *Bulletin of Entomological Research*, Vol. XII, 2nd part, pp. 135-163, figs. 8. London, 1921

Not less than 16 "species" have been described by different authors as belonging to the genus *Locusta* L. (= *Pachytylus* Fieb.). The number has however been reduced by earlier revisers, who synonymised many species, but KIRBY (1910) still mentions seven distinct species.

The author's investigations have however clearly demonstrated the variability of the species of *Locusta* to an extent far greater than might have been anticipated. He has arrived at the conclusion that only two species can be distinguished, viz., *L. migratoria* L. and *L. pardalina* Walk., but the latter differs from *migratoria* in so many important characters that the author has made a new genus (*Locustana* g. n.) to include it.

From a careful examination of the interrelations between the three forms of *L. migratoria* (*L. migratoria* L., *L. danica* L., and *L. migratorioides* Rch. and Frm.), the author regards it as proved that the three forms cannot be separated specifically, and that they represent taxonomic units of lower grade than the species which must be called, according to the law of priority, *L. migratoria* L. They are however quite distinct from each other, though connected by transitional forms.

As regards the term to be applied to these forms, the author thinks phase (from the Latin *phasa*; abbreviation — *ph*) to be the most appropriate. He considers that *L. migratorioides* is without any doubt the oldest form ("phase") of the species, since its morphological and colour characters are far more constant than the more plastic *L. migratoria*, to say nothing of the extremely variable *danica*. The permanent breeding regions of *migratorioides* have never yet been investigated, all that is at present known regarding them being based on the records of the occurrence of its swarms; these data enable it to be stated that the best conditions for the development of this form seem to be present in tropical countries with a rather damp, hot climate, but undoubtedly not in forests. Since on the other hand these breeding grounds seem to be yet undiscovered, we may presume that they are not in open grassy land, which is easily accessible and mostly cultivated or populated. The author is of opinion that they are to be sought somewhere deep in the impenetrable jungles, overgrown with high grasses, reeds and similar vegetation. It is a well-known fact that the development of *L. migratorioides* in its permanent breeding regions is subject to periodical rise and fall, but the exact cause of the increase of locusts is entirely unknown. When the increase is at its height, large swarms are formed and the locusts emigrate to their permanent habitats. These emigrated swarms settle down and lay their eggs wherever they are compelled to do so by purely physiological reasons, and their progeny undergoes a transformation into the solitary-living phase (*L. danica*).

The latter phase is very plastic and easily adaptable and more progressive; it must therefore play an important part in the extension of the range of the species, gradually but steadily populating new regions. Being

a product of a mutation arising partly from some unknown internal cause, and partly from outer (probably climatic) influences, *L. danica* is naturally subject to sudden displays of atavism which result in the transformation into the ancestral phase, *migratorioides*. This phenomenon is no doubt much favoured, and often probably caused by the fact that the oviposition of *L. danica* takes place in conditions similar to those of the permanent breeding grounds of *L. migratorioides*. The gregariousness of the individuals of this latter phase is certainly one of the causes of the rapid increase of the insects and their swarms, and soon, in the course of a few generations, the size of the swarms reaches the maximum point, and emigration follows. In this way, the dispersal of the species goes on alternately by the gradual spreading of the *L. danica* phase, and by the periodical extensive emigrations of *L. migratorioides*. As a result, the species is now distributed all over the Eastern hemisphere, but the distribution of *L. migratorioides* is confined to tropical regions, while *L. danica* goes over to the Palaearctic region as well, where the swarming phase of the species is represented by *L. migratoria*. This latter fact might be satisfactorily explained by the impossibility of finding in the Palaearctic region natural conditions exactly like those of the tropical breeding grounds of *L. migratorioides* chiefly as regards a combination of heat and dampness. The nearest approach to these conditions are to be found in the great districts covered with reed-beds in the Palaearctic regions, the deltas formed by the Volga, Ural, Kouna, Terek, Arax, Sir-Daria, Amou-Daria, Ili, etc., discharging into the Caspian and Aral Seas and Lake Balkhash; to which the permanent breeding grounds of *L. migratoria* are now restricted. Though of a quite special character and in the summer recalling the tropics, the climatic conditions of these reed-beds are of course not tropical, and their effect upon the progeny of the *L. danica* breeding in them is not the same as that exerted by the tropical breeding-grounds of *migratorioides*. The reverse transformation of *danica* into a swarming phase does not reach the phase of *migratorioides*, but stops half-way at the *migratoria* phase. This seems to indicate that the transformation is due primarily to the direct influence of external conditions, its extent being proportional to changes in these conditions, but only precise laboratory experiments can help to clear up this complicated problem.

As in the case of *L. migratorioides*, the development of *L. migratoria* in the permanent breeding-grounds alternates with periodical emigrations followed by transformation into the *L. danica* phase. Although the author's observations are far from complete, they leave no doubt that temperature is a factor of the utmost importance in the movements of larval swarms of locusts. From observations made in the North Caucasus, the average temperature causing the first movements of the larvae varies from 13° to 15° C. Under ordinary circumstances, that is to say provided the sun shines all day, and no unusual changes of weather occur, the swarms keep moving the whole day and as a rule do not feed while on the march.

In the afternoon, when the temperature begin to fall, the velocity of the insects' movements decreases until the evening, when the swarm

stops. It is interesting to note that this evening cessation of movement occurs when the temperature is again near 13°-15° C. All the observations so far made by the author have convinced him that the movements of the locust swarms are not determined by lack of food and hunger, as is the generally-accepted theory, but depend entirely on thermotropism (probably negative), and on another, as yet little known tropism which is displayed by the tendency of each larva to repeat the movements of its nearest fellows and to move in the same direction.

When the locusts are fit for flight, single individuals begin to take wing and fly for a short distance, often circling above the still sitting swarm. Whenever a locust flies near enough to another that is at rest, the latter is disturbed and often takes wing and flies in the same direction; this is again another manifestation of the same tropism which causes the movements of larval swarms. Sooner or later the whole swarm flies off. At first the insects do not take a definite direction, but as each individual tries to follow its nearest fellow, a common direction of flight must necessarily result. If two swarms meet, they mix together and the swarm gradually grows larger. The larger the swarms become, the longer and more regular also become their flights, and at last they assume a definite direction, and the insects take leave of their breeding region altogether. What is the cause of this emigration? The generally-accepted theory is that locusts migrate from want of food. The author however states that, as in the case of the larvae, hunger cannot be the incentive to emigration, especially if we consider the physiological changes occurring in locusts during the period of emigration. On dissecting individuals taken from emigrating swarms, it is seen that the greater portion of the inner cavity of the body is occupied by air-sacs, which are only temporary organs reaching their highest development at the period of emigration and disappearing towards the end of this period when the developing reproductive organs take their place. During the emigration, however, the air-sacs are enormously large and all the other internal organs, including the stomach, are much compressed, thus rendering the insect almost incapable of taking food, at any rate in large quantities. This assumption based upon anatomical facts, is supported also by field observations, for the emigrating swarms, when they stop their flight do not in fact feed much, though incidentally they may cause great damage by merely cutting the stems of cultivated plants.

Anatomical researches reveal also that the fat-body is more developed in insects just before and at the beginning of emigration, and is almost exhausted towards the end of it. Probably locusts during this period live essentially on the food-reserves in the fat-body, being unable to take much vegetable nourishment, and consequently scarcity or lack of food has nothing to do with the emigration.

In short, there is at present no possibility of explaining the emigration by any causes other than physiological; the development of the air-sacs compels the insects to fly, and this impulse is strengthened by their gregariousness, that is by some kind of tropism which makes each individual

keep close to its fellows and follow their movements. The reduction of the air-sacs and the exhaustion of the fat-body determines the cessation of the emigration.

The theory of phases suggests the theoretical possibility of the control of *migratoria* by some means directed not against the insect itself, but against certain natural conditions existing in breeding regions which are the direct cause of the swarming phase. Observations made in South Russia show that even comparatively slight cultivation of breeding-regions leads to the desired changes, preventing the transformation from the inoffensive solitary phase (*L. danica*) into the swarming phase (*L. migratoria*).

As regards *L. pardalina* Walk (for which as has already, said been the author created the new genus *Locustana*) the observations made by J. C. FAURE, in South Africa, and the author's examination of a large series of specimens from the same country have proved that like *Locusta migratoria*, it has two different phases, which differ in colour and morphologically, but more profoundly biologically. There is a sort of parallelism between the variation from the swarming phase (*Locustana pardalina* Walk.) and the solitary inoffensive phase to which the author has given the name of *Locustana solitaria*. The relations existing between *Locustana pardalina* and *L. solitaria* as regards morphological characters, the coloration in the larval and the adult stages, and the behaviour of the insect are very similar to those observed by the author in the case of *Locusta danica* and *L. migratoria*. J. C. FAURE's conclusions, which he arrived at quite independently of the author's work on *L. migratoria*, give a very strong support to the theory of phases as a direct cause of the periodicity of these locusts. It seems that in *pardalina* the transformation of solitary individuals into the swarming phase takes more than one generation, but the actual causes of the transformation are in this case as obscure as in *L. migratoria*. Data as to the migrations of the fliers and the fate of the migrating swarms of *pardalina* are not yet available. Further investigations of this problem closely connected with the careful study of all conditions of breeding-grounds, are extremely important from the point of view of locust control in South Africa.

G. T.

347 - *Isaria Eristalidis*, a Hyphomycete living on the Dipteron, *Eristalis tenax*, in Japan. — YASUDA, A, in *The Botanical Magazine*, Vol. XXXV, No. 420, pp. 219-221

MEANS  
OF  
CONTROL

This article contains a description of three new species of *Isaria* found in Japan living on insects: *I. japonica*, *I. Cosmopsaltriae* and *I. Eristalidis*. The last was observed on pupae of *Eristalis tenax* L. (European Drone-fly) (1), in the Province of Harima.

G. T.

(1) See R. Jan. 1919, No. 138. (Ed.)

346 - **New Species of Indian Braconidae.** — LYLE, G. T., *Bulletin of Entomological Research*, Vol. XII, Part. 2, pp. 129-132, figs. 2. London, 1921.

The author gives a description of the following species which are new to science :

1) *Microplitis similis* sp. n., a parasite of *Agrostis ypsilon* L., collected at Pusa and Sabour (Bihar and Orissa), and at Mokamah (Bengal) ;

2) *Microplitis eusirus* sp. n., reared from *Achaea janata* L., at Pusa ;

3) *Rhogas (Heterogamus) percurrans* sp. n. also reared from *A. janata*, at Pusa. G. T.

349 - **Control Measures against the "Pink Boll-Worm" (*Gelechia Gossypiella*) of the Cotton Plant, in Egypt.** — See No. 263 of this Review.

350 - **The Control of the Olive Fly (*Dacus oleae*) during 1920, in Greece.** — ISAAKIDES, C. A., Report of the work of the Phytopathological Service in Controlling *Dacus* during the Year 1920 in Chalcidice, Pelion and Messenia and of the results obtained, 48 pp., pl. 3 Athens, 1921.

In Greece, the olive-fly (*Dacus oleae*) causes an average annual loss of 25 000 000 "okes" of oil (1 oka = 2.755 lb), which at present price means a loss of 100 000 "drachmas" (1 drachma = 9<sup>23</sup>/<sub>64</sub>d. at par).

For a long time and on many occasions experiments in controlling the pest had already been made on a small scale ; mixtures with an arsenical base having been used with encouraging results, but it was not till 1920 that this method was adopted over an extensive area and for a really large number of olive-trees.

Operations on a larger scale against the olive fly were facilitated by the institution (by virtue of law No. 1366, of 1918) of the "Olive Bank" which was founded for the express purpose of providing the means of protecting and freeing the olive-tree from its animal and plant enemies. The funds of this Bank are supplied by : 1) a special tax on olives and olive-oil ; 2) a State grant ; 3) the profits from re-selling the ingredients, instruments and all apparatus necessary for controlling parasites. By Royal Decree, the special additional tax is levied on districts which already pay the tax on olives and olive-oil and where the communes have requested through their municipal councils that this tax should be imposed, in order that they may enjoy the advantages offered by the Bank.

The amount of this extra tax is apportioned in such a manner that part of the expenses of the Bank is defrayed by the State, and part by the olive-growers. The duties of the Bank consist in buying and distributing the ingredients and apparatus, giving information respecting the control of the parasites of the olive-tree and in itself carrying out the necessary treatments and thus setting an example to others.

The organisation and supervision of the scientific work of the Bank are entrusted to the Government Phytopathological Service.



It was decided in 1920 to adopt the usual measures against the Olive-fly at Polyghyros (Chalchidice), a district where there are about 150 000 olive-trees, in the Pelion district (about 2 700 000 olive-trees), and at Kyparissia, Erani and Platamodes (Messinia) (about 7 000 000 olive-trees), the total number of trees to be treated being 3 500 000.

On account of their size, the territories of Pelion and Kyparissia, Erani and Platamodes were divided into several sections in order to facilitate the control campaign. From one to four gangs of workers were appointed to each section, their number being proportionate to that of the trees and such as to allow each treatment to be applied within about a month. The work was directed and carried out entirely by an expert Staff under the general supervision of the Phytopathological Service.

According to the recommendations of the Service, the olive-trees were to be given during the 1920 season three successive sprayings, after which three vessels containing the insecticide mixture should be provided for every hundred olive-trees.

This mixture was composed of sodium arsenite 3  $\frac{1}{2}$  kg. ; molasses 110 kg. ; water 10 hectolitres.

According to the instructions given, about 320 gm. of the mixture were to be used for a tree of average size ; it was however found at Polyghyros, that 250 gm. were enough, and that larger amounts scorched the young leaves and shoots and also the fruits, without proving any more destructive to the olive flies.

In Pelion on the other hand, where the trees are larger, it was thought advisable to spray each tree with 320 gm. of the mixture the first time, 460 gm. the second, and with a still larger quantity for the third. After a few days' practice, the workers are able to spray each tree with the required amount of the mixture and one man can treat about 800 trees a day. In the case of the first and second sprayings, the mixture must be spread upon the interior of the foliage, but the third spraying must be directed upon the exterior of the tree, where the olive-flies are to be found at that time.

In all the zone to be treated, the first spraying must be begun towards the second fortnight in June, the lowest lying districts and those most attacked by the insect being first treated.

The second spraying begins towards the end of July and lasts about one month. The third treatment was begun at Polyghyros on August 22nd and finished on September 6<sup>th</sup>. In Pelion and Messenia, it was begun early in September and prolonged until the end of the month or the beginning of October. In every case untreated olive-trees were left as controls. Difficulties of a practical nature made it impossible to place the three series of vessels among the trees. As the three sprayings had proved satisfactory and are easier to carry out than fixing the vessels in the trees and keeping them replenished with the mixture which quickly evaporates, it was decided to substitute a fourth spraying for this part of the treatment. This spraying began on September 21 and finished on October 8 at Polyghyros and was generally adopted. In Pelion,

however, it lasted throughout October, but was only carried out in the districts most exposed to attack, this being all that was possible owing to the rains. In Messenia a few trees only were sprayed four times.

In spite of all the precautions adopted, it proved impossible to prevent all the injuries inseparably connected with the use of the insecticide, though considering the extent of the area in which the control was carried out, the cases of burns among the workers and transport animals were not frequent.

The application of the mixture with a molasses base caused the disappearance of ordinary flies and was also efficacious in destroying another Dipteron which is injurious to the olive-trees, *Lasioptera berlesiana* Paoli, known in Greece under the popular name of "xerouvoula". On the other hand, as was proved by special experiments, the mixture is harmless to bees.

Most satisfactory results were obtained by the control operations carried out in 1920 in Chalcidice, Pelion and Messenia. As a rule, 50, 80 and even 100 % of the fruit of untreated trees was attacked by the olive-fly, whereas all the trees that were sprayed remained perfectly immune. No occurrence of "fumagine" was observed as a result of the dachicida sprayings in any of the districts where the treatment was adopted.

A total of 8 341 kg. of arsenite of sodium and about 260 tons of molasses were used. The cost of the treatment at Polyghyros, Pelion and Messenia amounted to 622 563 drachmas (1 drachma = 9 <sup>33</sup>/<sub>64</sub> d. at par).

The larger crop of better quality obtained in 1920 owing to the control operations, brought in an immediate return of about 20 000 000 drachmas to the olive-growers, while the state benefited to the amount of over 800 000 drachmas, this being the tax on the part of the crop that had been preserved from the attack of *Dacus oleae*. G. T.

INSECTS, ETC.  
INJURIOUS  
TO VARIOUS  
CROPS

351. *Phthorimaea operculella* in Tunisia (1). — POUTILRS, R. in *Bulletin de la Société entomologique de France*, No. 2, pp. 30-31. Paris, 1922.

*Phthorimaea operculella* Zell, was found in October 1921 in Tunisia, but only at Sousse, where it had been introduced a few weeks previously. From enquiries made on the spot, it appears that this Microlepidopteron was disseminated in the district by some thousand kilos of Maltese potatoes which had been put on the market for "seed". Under such special conditions *Phthorimaea operculella* might easily spread, but as a very small quantity of potatoes are produced in Tunisia and these are quickly consumed, the insect will probably have little chance of living long or multiplying in the country. Further the Tunisian Agricultural Authorities have adopted certain measures of supervision which justify the hope that even if the pest succeeds in establishing itself in the neighbourhood of Sousse, it will be possible to destroy it on its first appearance elsewhere, or at least to prevent its spreading over a wider area.

(1) See R. Feb. 1922, No. 220. (Fd.)

If the infected potatoes were really grown in Malta from which they were shipped, the fact is one of considerable interest, as Malta will in that case have to be added to the list of places where *Pht operculella* is already known to work havoc  
G T

352 - "Potato Moth" (*Pthorimaea operculella*) in India. See No 351 of this Review

353 - *Neurotoma nemoralis*, a Hymenopteron Injurious to the Peach-tree, in France. — PAILLOT, in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol VII, No 38, pp 827-831. Paris, 1921

The existence of the peach tree orchards in the Rhone valley is seriously threatened by the Hymenopteron, *Neurotoma* (*Lyda*, *Pamphilus*) *nemoralis*. So far the damage seems to be confined to the territory of the Communes of Saint-Rambert d'Albon (Drôme) Adancette (Drôme) and Saint Désirat (Ardèche), but the advance of the insect is rather rapid. At Saint-Rambert the area of peach orchards utterly destroyed was three to four hectares in 1920, but rose to fifteen hectares in 1921, and it is probable the invasion will extend still further in 1922.

The author, from his own observations and the information collected in the course of his enquiries, is inclined to believe that the first appearance of *Neurotoma nemoralis* is confined to small centres that quickly extend from year to year. The development of these centres should be carefully watched and the insects destroyed before they have time to spread further.

In 1921 the moths began to fly towards the end of April but the chief laying season never begins before the 10th of May. The larvae hatch out six or eight days after the eggs are laid according to the temperature, and attain their full size in about a fortnight, when they burrow into the soil in order to pass the winter underground.

In 1921 the author began at Saint-Rambert a series of experiments in treating the centres where the largest number of moths had been seen on the wing and many eggs had been deposited in the leaves.

#### Experiment I — Nicotine and soft soap

Nicotine (100 gm per litre)	1 1/2 litre
Soft Soap	2 kg
Water	100 litres

The treatment was carried out on May 16th with a knapsack-sprayer, throwing a jet of 2 m, the hatching out of the larvae had just commenced.

#### Experiment II — *Quassia amara* and soft soap

<i>Quassia</i> (in chips)	1 kg
Soft soap	1 500 kg
Water	100 litres

The decoction of *Quassia* is prepared by boiling the chips for two hours in several litres of water. The treatment was carried out on the same estate where the nicotine had been sprayed previously.

**Experiment III — White hellebore powder and gelatine :**

White hellebore (rhizome) . . . . .	1.250 kg.
Gelatine . . . . .	100 gm.
Water . . . . .	100 litres

Treatment carried out on May 14th under the same conditions and in the same orchards that had been sprayed with the other two mixtures.

**Experiment IV. — Nicotined lime.**

A powder prepared by slaking quick lime with weak tobacco juice. An ordinary sulphating apparatus is used. Treatment carried out May 14th.

By way of experiment a late spraying was made with arsenate of lead towards the end of May, in an orchard that had suffered greatly from the ravages of the insect. It was most efficacious, but unfortunately the use of this insecticide cannot be recommended, as the French law prohibits the employment of arsenical mixtures after the flowering season, in the case of trees bearing stone-fruit.

The results of the spraying, as observed on May 28, were as follows :

Peach-trees treated with nicotine, *Quassia* and hellebore at the beginning of the hatching out of the larvae : condition very good ;

Peach-trees treated with nicotine several days after the larvae hatched out ; less satisfactory ; a fairly large number of living caterpillars present.

Peach-trees dusted over with nicotined lime . little different from the controls.

The formulae most to be recommended at present are those with a nicotine and *Quassia* base ; hellebore is efficacious but somewhat difficult to obtain. If the trees are very severely attacked, two sprayings are necessary at intervals of 5 to 6 days ; the first should be carried out as soon as the larvae begin to make their appearance. G. T.

354 — The Coccid, *Chrysomphalus aurantii*, in the Colony of Kenya, East Africa. — DRY, I. W., in *Bulletin of Entomological Research*, Vol. XII, Part I, pp 103-104. London, 1921

The presence of *Chrysomphalus aurantii* Mask. on the citrus-trees of the Colony of Kenya was reported for the first time in 1914. It is known that the Coccid was introduced by at least one consignment of imported citrus fruit which as it was provided with a certificate of immunity by the exporting country, had been admitted into the Colony without inspection. Thus it appears probable that *Chrys. aurantii* is not indigenous to Kenya. For this reason efforts were at once made to prevent its establishing itself in the Colony and with the hope of saving the citrus trees, and of preventing the pest attacking the coffee plantations, which are of far greater importance to Kenya than the orange and lemon groves, all importation of citrus fruits was at once prohibited and owners of citrus trees were required to destroy any that had been attacked by the Coccid.

Since 1917 the citrus gardens and nurseries have been inspected, and the owners requested to communicate the results of their investigations. It was ascertained in this way that *Chrys. aurantii* was widely distributed in the Colony, where it had attacked a large number of trees.

The insect was not only found on citrus trees, but also on rose-bushes, the apple-tree, plum-tree and on sisal.

Laboratory and field experiments have shown that so far the coffee trees have fortunately remained free from the pest.

The life-cycle of *Chrys. aurantii* has been followed in citrus fruits, but unluckily the extermination of the insect appears to be practically impossible. Since fumigation would be too costly, spraying is recommended as the best means of control.

G. T.

355 - *Rhagoletis suavis*, a Dipteron Injurious to *Juglans* spp., in the United States. -- BROOKS, F. D., in *United States Department of Agriculture, Bulletin* No. 992, pp. 1-8, pl. 1. Washington, D. C., 1921

*Rhagoletis suavis* (Loew) probably occurs fairly generally throughout the area of the natural distribution of *Juglans nigra* and *J. cinerea*. It has been found in the following States of the North American Confederation: Massachusetts, Minnesota, Indiana, Connecticut, New York, Ohio, District of Columbia and Virginia

This dipteron chiefly attacks the husks (epicarp), of *J. nigra* and *J. cinerea*. The author has however reared adult specimens of *Rh. suavis* from the husks of *J. regia* and *J. Sieboldiana*. Amongst these hosts the black walnut (*J. nigra*) and the Persian walnut (*J. regia*) are preferred to the others, probably on account of their thicker husks.

In the case of *J. nigra*, the eggs of the parasite are usually deposited so late in the season that the larvae do not prevent the nuts from ripening and dropping normally. Thus while apparently all the eggs are laid in nuts on the trees, the development of the larvae and the blackening of the husks which results from their feeding takes place chiefly in fallen nuts. In *J. regia* however the eggs appear to be laid earlier in the development of the nuts. Walnut-trees in Maryland and Pennsylvania were seen shortly before the crop ripened, to have a large percentage of the husks of the nuts blackened and the surface covered with a gummy exudation from the larval injury within. Some of the infested *J. regia* fruits drop prematurely, and others hang to the branches until after the sound nuts have fallen. In nuts attacked before maturity, the development is arrested and the kernel becomes unfit for use. The injury is thus threefold: the quality of the kernel is impaired, the husk sticks to the shell in the hulling process and the shell itself is discoloured making the nuts unattractive for market.

The author gives a detailed description of the different stages of the insect's development and of its habits.

Hitherto one parasite only of *Rh. suavis* has been discovered; this is a hymenopteron, *Aphaereta auripes* Prov. reared from the puparia of the Dipteron at Amherst (Massachusetts). A Rhynchote (*Lopidea*

sp.) was surprised by the author with its beak inserted through the skin of a black walnut sucking out the contents of a batch of freshly-laid *Rh. suavis* eggs.

In 1920 experiments in controlling the husk-maggot (*Rh. suavis*) were made with lead-arsenate sprays during the first ten days of August on two groves of *R. regia* laden with fruit, the one in Maryland and the other in Pennsylvania.

At New Windsor (Maryland), 3 pounds of lead-arsenate paste to 50 gallons of water were used for spraying; at West Willow 1 ½ pounds of lead arsenate powder to 50 gallons of water were applied; and some of the trees were sprayed with a lead-arsenate solution to which enough molasses had been added to give the liquid a slightly sweetish taste.

The trees of both groves had borne the previous season but the crops had been seriously injured by the larvae of *Rh. suavis*.

At the time the groves were sprayed the adult Diptera were appearing on the trees, and at West Willow a close examination of the nuts disclosed one batch of freshly laid eggs.

The nuts of the trees that had been sprayed at New Windsor were examined and counted just before the crop was gathered, and it was found that only 4 % of the nuts had been destroyed by the larvae, while at least 60 % had been attacked the previous year. At West Willow it was estimated that the conditions were 75 % better than the year before when no treatment was given. No Persian Walnut trees were found near either place that were suitable for use in checking the definite results of the spraying, but a comparison of the sprayed nuts with those produced by the same trees the previous season, together with the known abundance of the flies that appeared early upon the sprayed trees indicates decidedly beneficial results from the treatment.

Adult specimens of *Rh. suavis*, when confined in roomy wire screen cages, were also observed to feed freely on sweetened water to which sufficient lead arsenate had been added to give the liquid a milky colour though it must be admitted that these flies succumbed very slowly to the poison. More tests of this treatment must be made before it can be recommended unreservedly as an effective and sure method of control for this pest.

G. T.

356 - *Chloryta lybica* n. sp., a Rhyncote Injurious to the Vine in Libia — Dr. BERGEVIN, F., and ZANON, V., in *L'Agricoltura Coloniale*, Year XVI, No 2, pp. 55-64, figs. 4 Borgo S. Lorenzo, February 1922

In 1918, V. ZANON observed for the first time some isolated vine-stocks in a vineyard at Berka (Benghasi), which had yellowish second shoots (*feminelle* and *sottofeminelle*), although the July foliage as a rule quickly assumes the dark green colour of the spring leaves.

In the following years, the vines with yellowish leaves did not occur isolated, but in groups scattered throughout the vineyard; and also, whereas at first the lighter colour of the young leaves was due to the presence of yellow patches, these now extended over the surface of the

leaf which became wrinkled and curled, the edges being affected with necrosis, and finally fell. In addition all these second shoots were rachitic, and their internodes were shortened, at the same time a superproduction of buds was observed.

This affection had also been noticed in other vineyards at Berka, although no reason could be assigned for it until in August 1920, ZANON while examining a similarly affected vine on a trellis at Pùehat, found upon the lower surface of its leaves a light-green Rhynchote only a few millimetres in length and possessing great powers of jumping. After investigating all the vines that he knew to be abnormal, he became convinced that the affection was due to the Rhynchote which punctured the leaves thus causing them to turn yellow and fall. The puncture also acted as a stimulus causing the production of superfluous buds.

ZANON suspects that the supposed outbreak of Bramble-leaf recently reported in Tripolitania (1) was due to the effects of the attack of this Rhynchote which L. de BRIGLIN regards as a species new to science and describes under the name of *Chlorita lybica* G. T.

357 - **New Species of Curculionidae attacking Forest Trees in India.** — MARSHALL, G. A. K., in *Bulletin of Entomological Research*, Vol. XII, Part 1, pp. 165-180, figs. 1-13 (London 1921).

In this paper the author describes the following *Curculionidae*:

1) *Sympiezomias bicolor* sp. n. found in several parts of the Province of Madras feeding on the leaves of young teak (*Ictona grandis*) and in some cases delimiting the trees.

2) *Ilcides dipterocarpi* sp. n. bred from seeds of *Dipterocarpus* at Dehra Dun (United Provinces).

3) *Mecistocercus fumosus* sp. n. on *Pinus longifolia* and bred from the latter host plant in different places in the United Provinces and Punjab.

4) *Rhadinomerus bombacis* sp. n. bred from *Bombax Malabarica* at Pathri, Sarahanpur (United Provinces) and at Singhbhum (Bihar and Orissa).

5) *Rh. diversipes* sp. n., bred from *Eugenia Javanica* *Shorea robusta* and *Shorea* sp. in several parts of the United Provinces.

6) *Rh. malloti* sp. n. bred from *Mallotus philippinensis* at Lachiwala, Dehra-Dun (United Provinces).

7) *Rh. subfasciatus* sp. n., bred from *Shorea robusta* and *Shorea* sp. respectively at Jhabarkhet Dehra-Dun and Kotdiawara Lamsdowne Division (United Provinces), and from *Eugenia* sp. at Thano Siwalik Hills (Punjab).

8) *Rh. buteae* sp. n. reared from *Butea frondosa*, at Rani Range Siwalik Hills (Punjab).

9) *Ospilia odinae* sp. n. bred from *Odina Wodier* and *Cassia Fistula*, in several places in the United Provinces G. T.

(1) See R. Nov. 1921 No. 1174 (1d).

- 358 - **The Tussock Moth (*Lymantria monacha*), in Valais, Switzerland.** — BARBEY, A. in *Journal forestier suisse*, Year LXXIII, No. 2, pp. 21-25, 1 pl. Berne, February 1922.

The Tussock Moth (*Lymantria monacha*), made its appearance in Haut Valais, in 1921, in the lower part of the Cooches Valley (Gomserthal), where the Macrolepidopteron was on August 5th suddenly found to have invaded the Communal forest of Ernen. The zone attacked was situated at an altitude varying from 950 to 1000 metres and had a superficial area of about one hectare. It had been planted some 60 to 80 years previously, with *Picea* (Spruce) asto  $\frac{9}{10}$  and *Pinus sylvestris* (Scots pine) asto  $\frac{1}{10}$  all the trees were in good condition at the time, some of the spruces having attained the height of 24 metres.

The rains that fell towards the middle of August had hindered the insects from swarming and laying, but some of the moths had previously succeeded in depositing their eggs under the scales and within the crevices of the bark of the trees, choosing by preference those that had been severely damaged by the caterpillars. On September 15th countless clusters of eggs were found surrounding the lower portions of tree trunks of every size in the infested zone. On some trees a cluster was found on an average on every square decimetre. On the spruces and Scots pines alike, chrysalids and the remains of caterpillars and adult insect were discovered bearing traces of the attacks of their natural enemies.

The most likely explanation of this invasion would seem to be the following: the Tussock moth, which is of sporadic occurrence in Switzerland, succeeded in 1920 or possibly in the preceding year, owing to favourable meteorological conditions in penetrating into the Rhone valley from the basin of the Léman. Some couples of the Macrolepidopteron meeting in the Grengiols pass found their way, into the Forest of Ernen. The exceptional warmth of the spring and early summer of 1921 following a very mild winter caused the eggs that had been deposited in large numbers in July 1920, to hatch out. It is also possible that this part of the Conches Valley may have harboured this macrolepidopteron for years though the insects may not have succeeded before the summer of 1920 in laying a large quantity of fertile eggs.

Orders were at once given to fell during the winter all withered or half-withered trees having a great number of egg-clusters on the scales of their bark. As all trees attacked by the Tussock moth are irretrievably lost, these measures were adopted to prevent any subsequent incursion of xylophagous insects which generally act as secondary enemies.

The infested bark must of course be scrupulously burnt, and a careful supervision exercised over the surroundings of the infected zone, in order to ascertain that the invasion has been effectively checked. (G. T.)

- 359 - ***Platypus omnivorus*, a Beetle Injurious to Wood, in New South Wales.** - FROGGART, W. W., in *The Agricultural Gazette of New South Wales*, Vol. XXXII, Part 9, pp. 645-648, 1 pl. Sydney, 1921.

*Platypus omnivorus* Lea (the shot-hole borer), which was first recorded from Tasmania, is widely distributed through the New South



Wales coastal forests where it is commonly known as "brushes", or "cedar brushes".

The beetle is not noticeable during the winter months but is very active in December, January and February. It not only penetrates into the sap-wood but bores into the solid material of the logs for some distance. It also attacks newly-sawn boards while drying, but when after exposure for a month or so, the sap dries out, the timber loses its attraction and the borers leave it alone.

The principal timber, damaged by these beetles are beech (*Trochocarpa laurina*), blackwood (*Acacia melanoxylon*), corkwood (*Schizomeria ovata*), sassafras (*Doryphora sassafras*) and coachwood (*Cratogeomys apetalum*).

The general opinion of investigators is that preventive measures are the only means of combating insects of this type, such measures consist in the removal of all dead and dying trees from the forest area, and their destruction before the beetles develop and emerge from the infested wood.

When timber has been cut and stacked it is still liable to infestation until it is quite dry. The beetles can, however, be kept away by the use of carbolic sawdust sprinkled beneath the stack and between the layers of boards and battens as they are stacked. A 5% solution of water and carbolic acid is mixed in a bucket of sawdust and the moist sawdust is freely sprinkled over the timber. A saw miller to whom this method of treatment was recommended has had no further complaints to make of damage by the beetle to his timber since he has adopted these precautions.

G. T.

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INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

360 - **The Present Position of Agriculture in the Philippine Islands.** — HERNANDEZ, A., in *Government of the Philippine Islands, Department of Agriculture and Natural Resources, Twentieth Annual Report of the Bureau of Agriculture*, pp 1-65, pl. LIII, Manila, 1921.

There has never been greater prosperity among farmers nor has there been a year in which greater progress has been made in agriculture in the Philippines than in the year under review (1920). Many causes have contributed to this result but the most conspicuous are the following: 1) The Food Campaign combined with the Rice and Maize Fund which has greatly stimulated increased production; 2) the introduction of modern tractors and gang ploughs in the sugar-growing areas; 3) seed selection; 4) the importation of pure bred sires and consequent improvement of livestock; 5) the establishment and remarkable growth of Rural Credit among small farmers; 6) the establishment of poultry and swine stations and provincial and municipal plant nurseries; 7) the increase in the number of farm advisers and agricultural inspectors; 8) the organisation of a plant quarantine service to prevent the introduction of plant pests through importation.

During the period 1910-20, there was an increase of 45 % in the area planted with the 6 principal crops, viz. rice, maize, Manila hemp, sugar, coconuts and tobacco. For the 5 years 1915-19, the average yields of these crops per hectare were as a whole 21 % greater than those for the preceding 5 year period, and the yield per hectare in 1920 was 4 % above the average of the period 1915-1919, notwithstanding the damage sustained through typhoons and floods. This shows the advance made both

DEVELOPMENT  
OF  
AGRICULTURE  
IN  
DIFFERENT  
COUNTRIES

in area and in yield, but an even greater gain has been made in value. The value of these 6 crops has steadily increased from 159 055 329 pesos (1 peso = 50 cents U. S.) in 1915 to 687 131 502 pesos in 1920. Much of this increase in the value of the products is undoubtedly due to prevailing high prices during and after the war, but a large part is due also to the increase in acreage and yield.

The results obtained during 1920 were significant, not only as showing that better methods have produced better yields, but also as evidence of the able manner in which the farmers continued their cultural operations in the face of adverse weather conditions and floods, coincident with the time for planting and transplanting rice, and also the shortage of hired labour.

RICE (1). — The yield was 8 % greater than in that of the previous year and 33 % more than the average for the 5-year period 1915-19. The production of cleaned rice amounted to 1 019 400 metric tons and was nearly sufficient to supply the demand for local consumption, only 11 000 metric tons being imported.

SUGAR CANE. — The area planted was 1 % less than the previous year (197 403 hectares in all) but the yield was 3 % greater and the highest hitherto recorded, the total production being 423 580 metric tons; the increase in value was phenomenal and amounted to 114 %.

An experiment is in progress to determine which varieties will give good results under the local soil and climatic conditions existing in the La Carlota district, with particular reference to growth of plants and tonnage of cane per hectare.

Analytical tests are also in progress to ascertain the commercial value of old and also of newly introduced varieties.

Acclimatisation and quarantine work is being carried on, and with reference to the first, the varieties Cebu purple and Hawaii-109 promise well. Seed cane propagation, distribution and demonstration work have done much to show the Philippine planters the value of improved methods of cultivation. Experiments are being conducted also to determine the effect of wider or of closer planting on the yield of a given variety. Fertiliser experiments are being conducted with the Negros Purple variety to determine the value of lime and native fertilisers; burned lime, cane bagasse ashes, farmyard manure, filter press mud or cake, copra meal and bat guano have been applied in varying quantities. The value of the "Aquila" fertiliser and other varieties is also being tested.

From the breeding experiments so far conducted, the young plants from the seeds of Hawaii-20, Hawaii-27 and "Mountain" (large, white-unidentified) are showing the best results.

MAIZE. — The 537 135 hectares planted in 1920 gave a yield of 552 907 350 litres of grain; the highest yield obtained during the past 10 years.

(1) See No. 409 of this *Review*. (Ed.)

**TOBACCO.** — This crop also reached its maximum production for the past 10 years, the yield amounting to 64 893 metric tons of leaf from 101 123 hectares, as compared with 56 498 metric tons from 73 859 ha. in 1919, i. e. an increase of 15 % in production, 37 % in area and 52 % in value.

General cultural and seed selection work, acclimatisation of foreign varieties and other experiments have been carried on at Dammas and the newly established Cotabato Tobacco Station.

**COCONUTS.** — This crop has also created a record during the year, both with regard to the number of trees and the production of copra, which amounted to 361 605 metric tons and consisted of 382 tons of steamed copra, 197 693 tons of smoked copra and 163 530 tons of sun-dried product.

**MANILA HEMP.** — The area occupied was 559 356 hectares: 4373 ha. more than in the preceding year. The production increased from 148 341 metric tons to 165 081 tons.

For all these crops it is anticipated that there will be a further increase in production with the exception of the Manila hemp, the fall in prices having discouraged growers.

Among other crops, reference is made to : maguey (*Agave Cantala*) — with the increasing demand for substitute fibres, 30 567 hectares were cultivated as compared with 28 465 ha. in 1919, and the production was 18 178 metric tons as against 12 318 tons.

**VEGETABLES AND ROOT CROPS.** — The total area devoted to these crops was 141 211 hectares.

**LIVESTOCK.** — Steady progress has been made, showing that carabaos (buffalos) have increased 96 % (actual numbers 1 388 244) ; cattle 178 % (678 525) ; horses 79 % (255 380) ; hogs 90 % (3 129 776) ; goats 73 % (731 849) ; sheep 89 % (168 181).

The principal research work has been in connection with rinderpest. A vaccine has been prepared which will render highly susceptible animals, immune when given in 10 cc. doses. Calves and animals not full grown are given from 8-15 cc. Nearly all the inoculations so far made have proved successful. Experiments also with a semi-dry vaccine have given gratifying results. Hog cholera vaccine is being developed along similar lines. Immunisation experiments have been made with carabaos against tetanus, to ascertain their availability as producers of anti-tetanic serum.

An account is given of the general work and administration of the Bureau of Agriculture and the activities of its various departments. Attention is drawn to the excellent work done by the Demonstration and Extension Division which has done much to initiate the farmers into the modern practical cultural methods elsewhere proved successful.

The Fibre Division has conducted a campaign throughout the year to improve the methods of stripping and preparing fibre for the market "Prieto" fibre stripping machines were operated to demonstrate the practicability of their use for stripping maguey and sisal. Other similar machines have given good results.

M. L. Y.

361 - **Agriculture in Corfu.** — MALAMATIONOS, C. J., in *L'Economiste d'Athènes*, Year 1, No. 18, pp. 273-275. Athens, Jan. 19 to Feb. 1, 1922.

The chief crop in the island of Corfu which has an area of 240 square miles and a population of 90 000 inhabitants, is the olive which is grown on the hills. The oil is superior to the Cretan though slightly inferior to that of Mytilene. It is estimated that there are 2 559 000 olive trees in Corfu on an area of 170 000 *stremmes* (42 500 acres) yielding in a favourable year 19 312 500 kg. of oil. As a matter of fact this amount is rarely reached, for the methods both of cultivation and harvesting are poor, and moreover each year about  $\frac{1}{3}$  of the crop is destroyed by disease, involving a loss of about 15 million *drachmas*. The Ministry of Agriculture has taken steps to control the olive fly which is the most serious pest. The Berlese system has this year been applied in Corfu and an excellent crop is anticipated.

There are very few oil mills of any importance in Corfu, and less than  $\frac{1}{3}$  of the crop is treated in modern factories, the remainder all going to small native mills. The result is a loss both in quality and quantity and the same is the case for the oil of the pomace.

Most of the Corfu oil is sent to the Italian Riviera where it is refined and commands a high price. A refinery should be established in Corfu itself.

Apart from the olive, the vine is also a crop of some importance, the wine being valued at 5 million *drachmas*. The quality of the wine is very high, but owing to the spread of mildew, due to the damp climate, the vine is disappearing and being replaced by hay of poor quality.

There are a fair number of fruit trees, their product being chiefly exported to Piræus. Unfortunately the citrus plants are threatened by the "maladie de Poros" (root-rot and gummosis). This is bound to spread, as the growers reproduce chiefly by layering.

There is also a certain amount of production of cereals and vegetables, the latter being exported to Piræus. Amongst these the potato takes first place, the exportation in 1921 reaching 5 million kg., of a value of 2 500 000 *drachmas*.

The cereals grown in the island are insufficient for the local consumption and importation is necessary. Those most cultivated are wheat and maize. Production could be doubled by the use of modern ploughs, chemical fertilisers, and tested seeds. Agricultural cooperation has thus a great opportunity for fruitful activity. P. C.

#### RURAL HYGIENE

362 - **Fleas and the Methods of their Control.** — I BISHOPP, F. C., Fleas and Their Control, in *Farmers' Bulletin* 897, United States Department of Agriculture, 15 pp., figs. 5. Washington 1921. — II. DELANSE, P., Au sujet d'un piège à puces, in *Bulletin de la Société de Pathologie exotique*, Vol. XV, No. 1, pp. 39-41. Paris, January 11, 1922.

I. — The author describes in a popular manner the importance of fleas as agents transmitting infectious diseases to man (bubonic plague, infantile kala-azar etc.) and the lower animals (e. g. tapeworm to dogs) and as irritating and weakening parasites. He also gives an account of their life-history and of the means of exterminating them.

Of the known species of fleas (about 500), less than a dozen are of special interest as parasites of man and lower animals; the most important are the human flea (*Pulex irritans*), the dog flea (*Cnellocephalus canis*), the cat flea (*Cnellocephalus felis*), the fowl flea (*Echidnophaga gallinaceus*), and the rat flea (*Xenopsylla cheopis*), which spreads bubonic plague.

In order to control fleas, it is necessary to remove the centres of reproduction and destroy the parasites on infested animals. If the first operation is well carried out, the second gives but little trouble.

Fleas breed in large numbers in heaps of plant and animal refuse collected in damp shady, places protected from wind and rain. Stock should not be allowed to come near human dwellings, all excrement of any kind should be removed carefully and the place where it has lain (where the flea larvae develop, sprinkled with salt and then liberally watered. The infestation of houses can be prevented by keeping no animals indoors, taking up carpets and washing the boards, first with soap and then with petroleum. All the fleas harboured by domestic animals in a house can be destroyed by washing the hosts with dilute kerosene emulsive. This is prepared by dissolving 31 gm. of ordinary soap in 1 litre of boiling water; the mixture is removed from the fire and 1 ¼ litre of kerosene is added, stirring all the time; when the compound is well emulsified, 20 litres of water are added.

Fumigating houses with sulphur dioxide or hydrocyanic acid destroys rats, fleas and all other parasitic animals; 50-60 kg. of sulphur must be burnt per 1000 cub. m. of volume. Fumigation with hydrocyanic acid must be done with great care; the technique of the operation is described in the *Farmers' Bulletin* 699, intitled "Hydrocyanic Gas against Household Insects."

After the animal hosts have been treated and the house has been thoroughly cleaned, traps may prove useful. In order to attract adult fleas at night a small lamp can be placed in a dish of water covered with a layer of kerosene. Many of the insects may be caught by leaving a cat or guinea-pig in the room all night. The animal must be thoroughly washed in the morning with the solution referred to above.

To allay the irritation produced by flea-bites a 3% solution of carbolic acid, or tincture of iodine may be used.

This bulletin is the second edition revised of the *Farmers' Bulletin* No. 683, November 8, 1915.

II. — The author has used with success a light trap similar to that suggested by BRISHOPP but with oil instead of petroleum. He remarks that the trap only acts well if the doors and windows are properly shut so that no external light can penetrate into the rooms.

F. D.

363 — **Lathyrism** (1). — VISCO, S., in *Atti della Reale Accademia dei Lincei, Quinta Serie, Rendiconti, Classe di Scienze fisiche, matematiche e naturali*, Vol. XXX, Parts 5-6, pp. 241-244; Parts 7-8, pp. 270-279; Part 9, pp. 379-384. Rome, Second Half-Year, 1921.

A series of observations made on rats fed on the flour of *Vicia Ervilia*

(1) See *R.* July 1921, No. 701; *R.* Nov. 1921, No. 1008. (Ed.)

suggested to the author the possibility that the syndrome known under the name of "lathyrism" might be due to a lack of cereals.

In fact one animal, which after an exclusive diet of vetch meal manifested a complex syndrome, was completely and fairly rapidly freed from the symptoms by being fed a commercial product containing vitamins and an infusion (made with cold water) of the bran of *Andropogon Sorghum*.

Pigeons given the seeds of *Vicia Ervilia* manifested the same syndrome of symptoms as others that had been fed solely on polished rice, that is to say, they had every appearance of suffering from avian polyneuritis (due to an avitaminosis), but were cured by being given antiberiberic vitamins.

The rats fed upon bread made from the seeds of *V. Ervilia* (percentage composition of these seeds: nitrogenous substances 23.6; nitrogen-free substances 62.74; ash 3.45; water 13.15; starch 52.90; Crude fibre 5.50; fats 1.90), lost flesh continuously until they reached the limits beyond which it was impossible for life to be sustained, for their food was not sufficient for their requirements in energy, nor did it supply them with the necessary amount of nitrogen. The results of the experiment seemed to show that the deficit in the amount of nitrogen was due to the absence in the feed of some amino-acid radicle. F. D.

364 - **Flora of Maize Flour.** — THOM, C., and LE FEVRE E (Bureau of Chemistry, United States Department of Agriculture), in *Journal of Agricultural Research*, Vol. XXI, No. 4 pp. 179-188, bibliography of 8 works. Washington, 1921.

The authors in seeking possible causes for the well-recognised instability of maize meal, have found by means of cultures that many moulds and bacteria are generally present. The following species of moulds were found to be characteristic in many series of cultures: *Fusarium* sp., *Aspergillus repens*, *A. flavus*, *A. tamari*, *A. niger*, *Citromyces* (or *Penicillium* section *Citromyces*) sp., *Penicillium oxalicum*, *P. luteum* (several varieties), *Mucor*, sp. *Rhizopus nigricans* and *Syncephalastrum* sp. together with various yeasts and yeast-like fungi. Among bacterial groups, the colon-aerogenes group and lacto-bacilli were most abundant in fresh meal. Aerobic spore-formers and micrococci were always present and persisted in the stored product.

Within the range of composition found in the meals of commerce no bacterial activity was detected. Only one grade of unbolted meal showed signs of mould development below 13 % of moisture. Above 13 % of moisture, *Aspergillus repens* began to be an active agent of spoilage up to between 13 and 15 % of moisture, according to the form of milling practised. Several other species of mould are active in meal containing 16 % moisture, and numerous forms, including some bacteria, develop when 18 to 20 % of moisture is found.

Many samples of maize were extensively infected with *Fusarium*, *Diplodia*, *Aspergillus repens* or *Penicillium*, especially in the germinal area and in the tip of the kernel. These portions of the kernel are remov-



ed in varying degrees by different milling systems. The bolted meals examined showed a corresponding reduction in the number of viable organisms as shown by cultures.

F. D.

365 - **Suggestions for the Organisation of Stations for Agricultural Research in France and the French Colonies.** — *Revue de Botanique appliquée et d'Agriculture Coloniale* Year II, *Bulletin* No. 5, pp. 25-26. Paris, January 30, 1922.

AGRICULTURAL  
EXPERIMENTATION

In the course of its last annual Congress August 1921, the "Association française pour l'Avancement des Sciences" being convinced that : 1) the development of agriculture in France and its colonies should be one of the chief factors of the economic revival of the country ; 2) that scientific methods should be applied to the improvement of useful plants in France and its Colonies ; 3) that it is a proper function of the State to carry out the long experiments and studies necessary for the attainment of practical results, made the following recommendations :

a) That the already existing Experiment Station should be maintained and developed, and that there should be created in France and the Colonies, new specialised Stations for the study of the chief crops to be developed ;

b) That the public establishments engaged in plant acclimatisation or improvement that are already in existence, or that shall be created in the future (Agricultural Experiment Stations, Colonial Scientific Institutes), should be provided with adequate staffs and material and endowed with the means necessary for the continuation of their researches ;

c) That every Experiment Station dependent upon a State Service should draw up annually, before March 31, a report giving an account of the experiments made and the results obtained during the preceding year.

d) That the results obtained should be widely circulated ; that popular pamphlets dealing with the chief crops of the mother country and the colonies should be edited by specialists, printed in large numbers and distributed in the schools and among agriculturists and colonists ; finally, that large numbers of the seeds, cuttings or grafts of acclimatised or improved plants should be placed at the disposal of the public.

G. A. B.

366 - **Agricultural Experiment Stations in Czecho-Slovakia.** — 1. Agricultural Experiment Stations, *Bulletin of the Ministry of Agriculture of the Republic of Czecho-Slovakia*, Year III, No 1, p. 6. Prague, January 1, 1922 -- The Budget of the Ministry of Agriculture (1922). *Ibidem* -- III The Sale of the Stock of Chemical Fertilisers at the Ministry of Agriculture, *Ibid* p. 5.

I. — In Bohemia, Moravia and Silesia, there are 25 Experiment Stations devoted to or very closely connected with Agriculture. They are supported either by the State or by autonomous Societies. There are in addition some private Stations.

Most of the Stations have their headquarters in Prague, and this applies to the following which are subordinate to the Chamber of Agriculture : the Physiological Station, Experiment Station of Chemical Fer-

tilisers, Station of Agricultural Bacteriology, Institute of the Dairy Industry, Experiment Station for Testing Agricultural Machines, Soils Bureau, Station of Agricultural Chemistry, Institute of Agricultural Book-keeping, and the Seed Control Station. There is a large Provincial Agricultural Experiment Station at Brno in Moravia, which had a budget of 1 187 600 crowns in 1922; it is supported by an Administrative Committee (an Autonomous Body), and includes several sections. When its organisation is complete, this Experiment Station will be one of the largest in the world. The above Committee also supports an Institute for Plant Improvement, at Pířerov (Moravia).

Experiment Stations are also attached to most of the Agricultural Colleges, as for instance at Tábor, to which are annexed; the Agricultural Experiment Station, the Machine-Testing Station, the Station for the Cultivation of Forage Plants and the Phytopathological Station — at Roudnice; the Station of Agricultural Chemistry, and the Phytopathological Station — at Plzeň; the Dairy Industry Station — at Chrudim; the Plant Improvement Station — at Kroměříř, the Dairy Industry Station — at Prague, the Distillery Industry Institute and the Scientific Brewery Institutes. These two last Stations are annexed to special private schools, while a Carpentry Institute forms parts of the Technical College of Prague, etc.

In Slovakia, the Government has instituted Stations at Bratislava, Košice and Stávnice.

Arrangements are being made for the organisation of other Experimental Stations for the different branches of Agriculture (pisciculture, aviculture, silviculture, improvement of cattle breeds). At the present time, the Nēm-Brod Potato Cultivators' Union is engaged in organising, with the assistance of the Ministry of Agriculture, a special Station on the Valečov estate.

All the Czech Experiment Stations are united in a Federation having its head-quarters in Prague.

In conclusion, there are the private Experiment Stations — the Sugar Industry Station in Prague — the Dobruřice—Seměice Station for the Improvement of Seeds especially those of the sugar-beet, the Joint Stock Company "Thurn-Taxis" which deals with the agriculturists of the different districts of Bohemia, and exports a considerable quantity of sugar-beet seed — the Stations of Chlumec (Nolč-Dreger), Nalžov, etc.

II and III. — The Ministry of Agriculture has included in its 1922 Budget 18 514 427 crowns for Experiment Stations, and 31 399 941 crowns for Primary and Secondary Schools of Agriculture; the support of the Agricultural Colleges devolves upon the Ministry of Education. In addition the profits from the stocks of chemical fertilisers on sale at the Ministry of Agriculture will be employed for the foundation of an Experimental Institute of Agriculture and Silviculture, the Agricultural Museum and other objects of importance to agriculture.

G. A. B.

367 - **The Standardisation of Field Experiments.** — WIANCKO, A. T., ARNY, A. C., SALMON, S. C. (Committee on Standardisation of Field Experiments), in *Journal of the American Society of Agronomy*, Vol. XIII, No. 3, pp. 368-374, bibliography Lancaster, Pa., January 28, 1922.

The Committee appointed by the American Society of Agronomy for standardising the methods of conducting field experiments has for many years been making a careful study of the question. Information concerning the practice of the majority of the Experiment Station workers in the United States has been collected. With the data at hand, the Committee now feels that the Society of Agronomy should begin to define and adopt certain standards for locating, laying out and conducting the ordinary kinds of field experiment.

The great variety of conditions under which field experimental work must be done makes it impossible in certain respects to lay down any but very general rules. Some guiding principles can, however, be fixed in order to make such work more uniform and the results more accurate. The chief points in the authors' paper may be summarised as follows.

**RECOMMENDED STANDARDS FOR FIELD PLOT EXPERIMENTS IN SOIL FERTILITY.** In each locality, one type only of soil should be represented in any one experiment. It is therefore necessary before beginning the experiments to ascertain the uniform character of the piece of land chosen. Topographically it should be reasonably level and slope in one direction only; otherwise special precautions must be taken to prevent soil-washing. When artificial drainage is required the drains should be so arranged as to influence all plots alike. Where irrigation is practised, provision must be made to water all plots at the same time and at the same rate. While the size of the plots must often be governed by the number of plots required for the particular experiment and the amount of land available, twentieth-acre to tenth-acre plots will usually be found the best where horse and machine labour are to be used. Long, narrow plots laid out crosswise to the greatest soil variation are preferable to square or oblong plots as these are more likely to show important differences in soil fertility. The four corners of any series of plots should be indicated by permanent marks. Check plots receiving a uniform soil treatment to maintain them in a reasonable state of productivity should be regularly distributed throughout the series. At least every fourth plot, preferably every third, should be such a check plot in each series, and one or more untreated plots should also be included. The complete series of treatments should be repeated as many times as there are crops in the rotation employed. In all soil fertility experiments the plots must be separated by untreated interspaces at least 3 ft. in width, and the entire series of plots should be surrounded by regularly planted side and end border strips to be cut off at harvest time. Only high quality acclimatised seed of standard variety should be used and it must be uniformly treated. The calculation of increases due to treatment should be based on the assumption that the difference between the two checks is uniformly progressive. All cultural operations, except ploughing, should be conducted lengthwise of the plots.

to prevent all possibility of moving soil or fertiliser from one plot to another. Ploughing should however usually be crosswise of the plot, and hill-planted crops may be cross-cultivated. Yields ought usually to be determined by harvesting and weighing the produce of the entire plot; the produce must be uniformly dried before weighing. Should this have been omitted, the moisture content ought to be determined and proper corrections made before recording the weights.

**RECOMMENDED STANDARDS FOR FIELD EXPERIMENTS WITH FARM CROPS.** — All seeds used for planting must be of known vitality and free from mixture, weed-seeds and contamination or infection by disease. The soil for experimental plots ought to be as nearly as possible of the type prevailing in the area where the data from the crops grown on them are to be applied. As a rule, relatively long and narrow plots are to be preferred, but they must be sufficiently wide to allow for the removal of border-rows (2 in the case of cereals and 1 for intertilled crops). Practically, 5 ft. or more is a good width for plots planted with small grains and forage crops; in the case of intertilled crops, sufficient width must be allowed for 4 rows. Adequate repetition of varieties or treatments renders unnecessary the use of check plots. In fact the number of years a test is continued together with the number of plots devoted to any one variety or treatment, and the size of the plots are in definite relation to the probable error for any particular test. When single plots of varieties or treatments are used, the probable error will average lower on tenth acre plots than on plots of smaller size. The increase in probable error is however relatively small when the decided reduction in size of the plots is considered. By repeating varieties or treatments a sufficient number of times on regularly distributed plots of any size adapted to the purpose of the experiment, the probable error for the test may be reduced to any point considered necessary. For ordinary conditions, from 2 to 5 repetitions are recommended, 2 plots of any variety or treatment, continued through 4 years, or 3 plots continued for 3 years, should be regarded as the minimum. New varieties and cultural methods or treatments materially different from those in common usage should not be recommended for general use, unless supported by at least 3 years of repeated and carefully conducted experiments within the area for which the recommendations are made.

To the article are appended additions to the bibliography published in 3 previous issues of the Journal of the American Society of Agronomy.

G. A. B.

368 — **Experimentation and Yield of Cotton, Sugar Cane, Bay Trees, and Other Crops in Montserrat, West Indies.** — *Imperial Department of Agriculture for the West Indies, Report on the Agricultural Department, Montserrat 1919-20, pp 1-40 + tables. Barbados, 1921*

**I. COTTON.** — As the result of successful cultivation of the strain H23 from 1916-19, further tests were made which proved the undoubted superiority of this strain as regards cropping qualities. This is evident

also from the comparative data referring also to strains Hg and D1. Special note is made of the particularly good results obtained with type H23-2-13 which gave a yield at the rate of 921 lb. per acre. Special work was undertaken to analyse the characters of the individuals of this strain for the purpose of securing mother plants as starting points for a new race with an efficiency above the average of the type. Data relative to the lint length, seed weight, lint index, lint and seed-cotton per boll, percentage of lint, bolls per lb., seed cotton and average number of loculi per boll are given.

New selections are also being made from the Hg strain and several new crosses have given interesting results.

Comparative trials with St-Vincent, Montserrat and St. Kitts cottons are reported and it is noted that the types were placed in the above mentioned order of merit after ginning and forwarding to the factory for spinning tests.

From the 3 200 acres planted in cotton the total yield amounted to 548 334 lb. of lint, i. e. an average of 171 lb. per acre. The practice largely followed was to leave two cotton plants per hill instead of one, and as the results proved most satisfactory, this method is most likely to be followed in the future.

A certain amount of the cotton seed employed, showed lack of viability, and it is advised that as non-viability is due to fermentation or heating of seed-cotton in bulk after picking, seeds which are to be reserved for sowing should be exposed for a longer time to the sun. Trials have shown that if exposed for one week, seeds have proved as viable as when brought from the field.

The type of cotton now cultivated appears to be remarkably free from attacks of bacterial disease in its various forms, and where the second crops were harvested early, the damage from cotton stainers (*Dysdercus* spp. and *Oxycarenus* spp.) was negligible; late planted areas however suffered badly from attack.

II. — SUGAR CANE. — Comparative trials were made with 22 varieties of cane. Samples of each variety were crushed and the juice, preserved with formalin, was sent for analysis to the Government Laboratory at Antigua. The field results together with the results of chemical examination are given in tabular form. First on the list as regards sucrose value comes the B.H10 (12) with an average return of cane per acre for 2 years of 31.25 tons, giving the average amount of sucrose per acre as 8 180 lb. The next, namely Scaly Seedling gave a somewhat higher average for canes, viz. 33.6 tons, but a lower sucrose production, viz. 7 370 lb. These two varieties stand first also in the records made as regards the ratoon canes. In 1920 the first mentioned gave 18.1 tons of cane per acre and the second 11.5 tons.

The success obtained with this new variety B. H. 10 (12) confirms the results obtained in other West Indian islands.

III — BAY TREES (*Pimenta acris*) (1). — Reaping of the leaves

(1) Reproduced in *Agricultural News*, Vol. XX, No. 503, p. 246, London, Aug. 6, 1921 (Fd.)

for distillation has been in progress since 1911 and has continued systematically up to the present time (*West Indian Bulletin*, Vol. XV, pp. 176-197). During the 1919-20 season 52 distillations were made and samples of oil from each distillation (100 cc) were submitted to Antigua for examination. The average yield of oil per 100 lb. of green leaves was 17.3 oz.; the phenol content varied from 48 to 63 %. It is interesting to note the rise in yield from 1368 lb. green leaves in 1911 to 8020 lb. in 1919 and the rise in value per acre from £7 to £60. Frequent distillations were made throughout the year to ascertain the most favourable season for carrying out these operations. Details may be found in the Annual Reports of the Botanic Station.

The best average results as regards oil yield were obtained between January and July, but this has been attributed to the dry weather prevailing at this season.

As regards the quality of the oil as indicated by the specific gravity and the phenol content between which a certain correlation is evident, the best results were obtained between March and October.

In consideration of the fact that only fully developed leaves have been used for distillation, nothing has been attempted when the trees were making new growth. The bay trees on the experiment plot are so treated that collections of leaves can be made from ground level, the trees being sawn off and the leaves stripped later. It has been found satisfactory to cut down the trees once a year.

Further investigations must be made as to the right conditions of the leaves when collected as results have been disappointing in cases when very old leaves have been collected.

IV. MINOR CROPS: 1. *Yams* (*Dioscorea* spp.) — Experiments were made to ascertain the advantage of staking the haulms, and results showed an average gain of nearly 100 % over unstaked plants. The heaviest cropper on the average of 3 years' results proved to be the variety Antigua Lisbon with an average yield per acre of 23 267 lb.; this variety is also of good cooking quality.

2. *Sweet potatoes*. -- Data are given for the average results of, the 16 varieties tested. The variety Red Bourbon gave the highest yield the average yield per acre being 13 258 lb.

3. *Datura Metel*. — Dried leaves and ripe seeds of this local plant have been submitted for examination to the Imperial Institute, London to determine the commercial value of the product as a source of scopolomine. Manufacturers reported that satisfactory results were obtained with the leaves and on treating 250 lb. a yield of 0.518 % of crystallised hyoscyamine and 0.0542 % of hyoscine was given. The proportion of hyoscyamine and scopolomine in the seeds is evidently variable, approximately in the ratio 8 : 1 and this appears to be the first recorded instance in which the hyoscyamine was the predominating alkaloid to such a pronounced degree. The commercial value of the seed is, however, of a doubtful nature, as other available materials contain larger proportions of these alkaloids.

4. *Momordica cochinchinensis*. — A limited number of plants were raised for the first time, and the seeds obtained were sent to Antigua for analysis of the oil content. The seed was composed of shell 38.1 % and kernels 61.9 %; the former contained 0.80 % fat and the latter 52.06 %. The fat obtained was of the consistency of castor oil.

5. *Wind-break plants*. — The results obtained with the following plants are reported. White cedar (*Tecoja Leucoxydon*), Machineel (*Hippomane Mancinella*), Spanish ash or oak (*Inga laurina*), Galba (*Calophyllum Calaba*), Angelin (*Andirna inermis*), Bread-and-cheese (*Pithecolobium Unguis-cati*) and *Pimenta acris*

M. L. Y.

369 — **The Establishment of the West Indian Agricultural College in Trinidad** — In *Agricultural News*, Vol. XX, No 512, pp. 385-386 Barbados, Dec 10, 1921, and *The Louisiana Planter and Sugar Manufacturer*, Vol LXVIII, No 6, p 53 New Orleans, Feb 11, 1922

AGRICULTURAL  
INSTITUTIONS

The object of the establishment of the West Indian Agricultural College is to promote the study of agriculture in the Tropics and to provide instruction in the cultivation and marketing of tropical products of every kind, including sugar, and its by-products, rum, molasses, cacao, coffee, cotton, coconuts, rice, citrus fruits, etc, dye weeds and all vegetables, mineral and marine products of the British West Indies (including British Guiana and British Honduras) to make full provision for research work and for the training of scientific investigators in matters relating to tropical agriculture, with a view to creating a body of expert agriculturists capable of founding, establishing and maintaining other colleges, etc., of a similar nature

Further information as regards the development of the College, the various ways in which West Indian natives are likely to benefit etc will be forthcoming.

M L Y

## CROPS AND CULTIVATION

370 — **Studies on the Reduced Yield of the Chief Farm Crops, especially as caused by Adverse Weather Conditions in the United States.** — VALGREN, V N, in *U S Dep. part of Agric, Bull. No 1013, Office of Farm Management Farm Economics*, pp 123 Washington, January 1922.

AGRICULTURAL  
METEOROLOGY

**THE FREQUENCY AND INTENSITY OF ADVERSE WEATHER CONDITIONS** — It is well known that the great variations observed in the yields of cultivated plants are due to unfavourable weather conditions, plant diseases and animal pests. In order to be able to estimate the loss entailed, the author lays stress at the outset on the necessity for a clear definition of the terms "loss" or "damage", when used in connection with crops. The expression "crop damage" should be applied to a loss caused by the inferiority of a crop yield in a given region to the maximum owing to unfavourable weather conditions, whereas the term "financial loss" ought to be reserved for cases where the loss was not only crop damage, or a diminution in yield, but a financial loss on the season's operations.

Let it be assumed that 3 farmers (X, Y and Z) are engaged during a given year in producing wheat by dry-farming methods in three semi-arid regions of the West, and that the average yield in each of these regions for the last 20 years has been 8 bushels an acre which would be sufficient to cover all proper charges. In exceptional years, 35 bushel yields have been harvested on each of these farms.

If in the district where X works average conditions prevailed throughout the year and he actually reaped an 8 bushel crop he has had neither profit nor loss, though his prospects were early reduced by natural causes. If the climatic conditions had been entirely favourable, he would have reaped 35 bushels per acre. Where Z was farming, all the conditions remained highly favourable until within two weeks of harvest time, when a hailstorm destroyed 60 per cent of his crop, which gave an actual yield of 14 bushels per acre. In this case there is no financial loss, the farmer realised a profit in as much as 8 bushels per acre covers all charges.

On the other hand the crop was undoubtedly damaged by the hail, and if he had insured it he would have been entitled to an indemnity equivalent to 60 % of his insurance per acre.

Finally Y, who because of frosts and drought reaped no harvest whatsoever suffered, a loss equivalent to his entire expenditure of labour and capital chargeable to the year's operations, and this is a case of true "loss."

Even after this attempt at clear definition one of the terms "crop damage" still retains a vagueness which it seems impossible entirely to remove. It implies that the best crop yet harvested was perfect having suffered no damage of any kind, whereas it may well be questioned if any such crop has as yet been reaped. It is also obviously impracticable to arrive at any figures representing the "crop damage" for a larger area, or for the country as a whole.

In order to obviate these difficulties and to make it possible to work out approximate figures for the amount of crop damage from various causes, the United States Department of Agriculture has arbitrarily assumed that a crop exceeding by 10 % the normal yield is a perfect crop. The normal yield is defined as the yield which has been observed by the crop-reporter actually to occur over extended areas in the ratios used in reporting on crop prospects as well as crop damages from different causes.

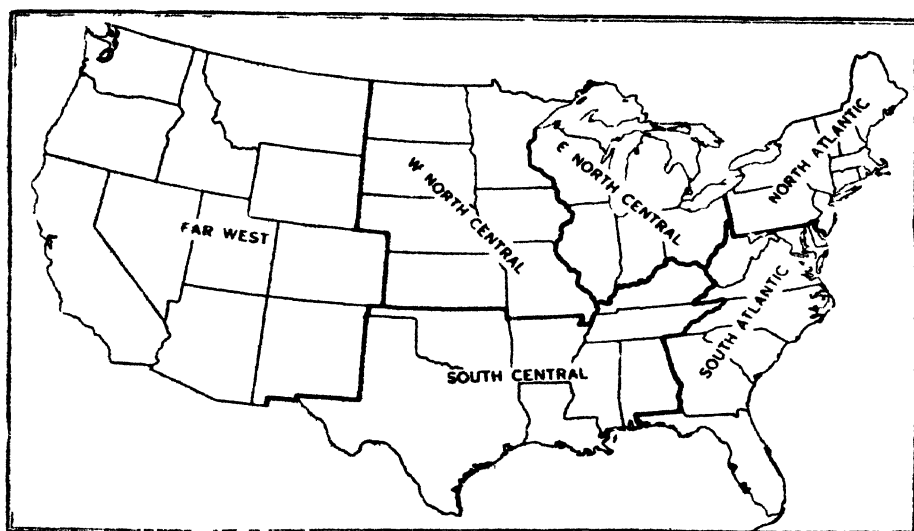
The difference between a perfect or "no damage" yield and the actual yield, is the measure of "total crop damage." About 12 years ago the United States Department of Agriculture began to require of its thousands of crop reporters in all parts of the country estimates of the percentage of damage caused by adverse weather conditions. The returns were to be expressed in % of the normal crop and calculated according to the standard indicated above.

The crops covered were maize, wheat, oats, rice, barley, flaxseed, potatoes, tobacco, hay and cotton. Table I gives the data relating to



the 3 leading crops wheat, maize and cotton. The figures represent the average annual damage during the decade 1909 to 1918 in the 6 great geographical divisions of the United States: North Atlantic, South Atlantic, East North Central, West North Central, South Central and Far West (See figure).

The purpose of Table I is to bring out the relative importance of the different risks or causes of damage with reference to each of the crops enumerated for the country as a whole as well as for the various geographical divisions. Thus in the case of maize, deficient moisture was the most dangerous risk, not only for the country as a whole, but also for all the geographical divisions, after drought come excessive moisture, frosts, insect pests and hot winds.



Geographical Divisions of the United States referred to in Tables I and II

The figures in Table II represent, not only the relative severity of the risks or causes of damage, in each case, but also the importance from the point of view of the acreage or volume of the given crop in the division or the country as a whole.

It is evident that the data given in the two Tables cannot always correspond. Thus according to Table I an average of 112% of the maize crop was lost annually through hail, which was a higher percentage of hail damage than occurred in any of the other 5 divisions, but owing to the relative unimportance of the maize crop in the Far West, the total hail damage was only 300 000 bushels.

On examining Table II it is seen that deficient moisture is again the chief cause of crop damage for each of the crops mentioned, excessive moisture, however, ranks second for maize, oats, rice, tobacco and hay.

TABLE I. — *Average Annual Crop Damage (in % of Normal Yield) by Geographic Divisions for Decade 1909-1918.*

Crop and Geographical Division	Total loss	Losses caused by climatic conditions										Plant diseases	Insect pests	Animal pests	Other unspecified causes	
		Deficient moisture	Excessive moisture	Floods	Frosts	Hail	Hot winds	Storms	Other climatic causes							
MAIZE																
North Atlantic . . . . .	24.14	9.58	4.55	0.18	3.57	0.36	0.20	0.61	0.70	0.16		2.23	0.17	1.83		
South Atlantic . . . . .	21.07	9.62	4.31	1.24	0.63	0.33	0.39	0.64	0.24	0.27		2.28	0.15	0.97		
East North Central . . . . .	28.73	11.04	4.79	0.75	4.65	0.26	1.43	0.74	0.43	0.15		2.88	0.10	1.62		
West North Central . . . . .	36.38	19.22	3.64	0.69	3.64	0.69	3.27	0.30	0.51	0.14		2.77	0.23	1.29		
South Central . . . . .	34.62	20.98	3.31	1.28	0.60	0.34	2.80	0.73	0.34	0.37		2.76	0.15	0.96		
Far West . . . . .	29.89	17.51	0.73	0.29	3.43	1.12	0.72	0.12	0.50	0.49		2.94	0.96	1.08		
Averages . . . . .	31.99	16.19	4.00	0.88	2.85	0.44	2.29	0.52	0.44	0.22		2.70	0.17	1.29		
WHEAT																
North Atlantic . . . . .	16.81	3.37	1.36	0.14	1.29	0.24	0.15	0.16	5.18	0.47		3.15	0.03	1.27		
South Atlantic . . . . .	17.61	4.64	2.21	0.39	0.96	0.47	0.24	0.27	3.12	2.23		1.54	0.06	1.48		
East North Central . . . . .	23.06	3.59	2.28	0.38	0.82	0.20	0.44	0.16	9.51	0.77		3.88	0.01	1.02		
West North Central . . . . .	33.04	14.59	2.33	0.35	0.48	1.49	2.99	0.30	3.79	3.92		2.02	0.11	0.67		
South Central . . . . .	32.17	18.09	2.63	0.44	0.33	0.72	1.60	0.19	2.71	1.48		2.77	0.09	1.22		
Far West . . . . .	23.48	12.96	0.77	0.24	1.32	1.22	1.42	0.29	1.81	1.21		0.62	0.82	0.80		
Averages . . . . .	28.77	12.38	2.03	0.33	0.70	1.10	2.02	0.26	4.13	2.65		2.12	0.19	0.86		
COTTON																
South Atlantic . . . . .	27.09	6.60	6.75	1.10	1.99	0.48	0.99	0.60	0.77	3.03		2.85	—	1.93		
South Central . . . . .	38.83	14.53	3.42	1.03	1.05	0.48	1.75	0.75	0.57	1.60		12.35	0.03	1.26		
Averages . . . . .	35.49	12.29	4.34	1.05	1.32	0.48	1.56	0.71	0.60	2.00		9.67	0.02	1.45		
OATS																
Averages . . . . .	24.52	13.44	2.73	0.31	0.38	0.77	1.90	0.43	0.80	1.73		0.89	0.08	1.06		
BARLEY																
Averages . . . . .	28.65	17.06	1.78	0.14	0.68	1.32	3.17	0.36	0.43	1.65		0.74	0.27	1.05		
FLAX-SEED																
Averages . . . . .	36.44	21.06	1.25	0.14	3.97	1.72	3.04	0.22	0.39	2.19		0.95	0.09	1.42		
RICE																
Averages . . . . .	19.04	6.67	3.14	1.47	0.24	0.02	0.43	1.85	0.23	1.18		0.76	0.29	2.76		
POTATOES																
Averages . . . . .	30.12	14.55	3.08	0.25	1.57	0.14	0.73	0.04	0.45	4.35		3.23	0.08	1.65		
TOBACCO																
Averages . . . . .	20.50	8.72	3.65	0.64	1.02	0.81	0.19	0.34	0.39	0.40		2.59	0.01	1.74		
HAY																
Averages . . . . .	20.35	13.44	1.74	0.31	0.62	0.11	0.58	0.15	1.45	0.10		0.52	0.08	1.25		

TABLE II — Average Annual Crop Damage from Specified Causes, in Bushels, Pounds, or Tons, by Geographical Divisions for Decade 1909-1918.

Crop and Geographical Division	Total loss	Adverse weather conditions						Other climatic causes	Plant diseases	Insect pests	Animal pests	Other unspecified causes	
		Deficient moisture	Excessive moisture	Floods	Frosts	Hail	Hot winds						Storms
MAIZE (bushels)													
North Atlantic . . . . .	31.9	12.3	6.3	0.2	4.9	0.5	0.3	0.8	0.9	0.2	2.9	0.2	2.4
South Atlantic . . . . .	87.2	39.8	17.5	5.1	2.8	1.4	1.6	2.7	1.1	1.1	9.5	0.6	4.0
East North Central . . . . .	317.4	120.8	53.0	8.3	53.0	2.8	15.5	7.0	4.8	1.7	31.6	1.1	17.8
West North Central . . . . .	388.0	310.8	57.1	10.8	61.4	11.2	52.3	4.7	8.3	2.3	44.5	3.8	20.8
South Central . . . . .	313.7	189.0	31.7	11.5	5.0	2.8	24.9	6.7	3.4	3.5	24.6	1.4	9.2
Far West . . . . .	7.3	4.3	0.2	0.1	0.8	0.3	0.2	—	0.1	0.1	0.7	0.2	0.3
Totals . . . . .	1 345.5	677.0	165.8	36.0	127.9	19.0	94.8	21.9	18.6	8.9	113.8	7.3	54.5
WHEAT (bushels)													
North Atlantic . . . . .	6.9	1.3	0.6	0.1	0.5	0.1	0.1	0.1	2.2	0.2	1.3	—	0.4
South Atlantic . . . . .	8.9	2.3	1.1	0.2	0.4	0.3	0.1	0.1	1.8	1.1	0.8	—	0.7
East North Central . . . . .	35.1	6.1	3.6	0.6	1.3	0.3	0.8	0.3	12.7	1.2	6.3	—	1.7
West North Central . . . . .	179.3	77.4	13.9	2.0	2.6	8.3	16.5	1.7	18.5	22.5	11.6	0.6	3.7
South Central . . . . .	27.5	14.5	2.7	0.4	0.2	0.7	1.2	0.2	2.6	1.4	2.5	0.1	1.0
Far West . . . . .	43.5	24.5	1.3	0.4	2.3	2.2	2.7	2.5	3.3	2.2	1.2	1.5	1.4
Totals . . . . .	301.2	126.1	23.2	3.7	7.3	11.9	21.4	2.9	41.1	28.6	23.9	2.2	8.9
CORROD (pounds)													
South Atlantic . . . . .	870.4	213.3	214.8	35.4	64.8	15.4	31.8	19.7	24.3	95.8	93.8	0.1	61.1
South Central . . . . .	2 860.6	1 078.7	249.8	74.5	75.7	35.0	129.2	51.1	42.1	114.2	912.6	2.4	93.3
Totals . . . . .	3 731.0	1 292.0	464.6	109.9	140.5	50.4	161.0	72.8	66.4	210.1	1 006.4	2.4	154.4
OTHERS													
OATS (bushels) . . . . .	414.3	277.8	46.0	5.0	6.5	13.4	32.3	7.3	12.5	29.2	15.3	1.5	17.5
BARLEY (bushels) . . . . .	74.1	44.7	4.5	0.4	1.9	3.2	7.8	0.9	1.2	4.0	1.9	0.8	2.8
FLAX-SEED (bushels) . . . . .	10.2	6.0	0.3	—	1.1	0.5	0.8	0.1	0.1	0.6	0.3	—	0.4
RICE (bushels) . . . . .	7.4	2.7	1.3	0.6	0.1	—	0.1	0.7	0.1	0.4	0.3	0.1	1.0
POTATOES (bushels) . . . . .	164.8	78.0	17.2	1.3	8.9	0.8	3.9	0.2	2.5	25.3	17.4	0.5	8.8
TOBACCO (pounds) . . . . .	296.3	119.0	55.4	10.0	15.6	12.1	2.7	5.3	5.9	5.5	36.9	0.1	23.5
HAY (tons) . . . . .	20 414.0	13 442.0	1 667.0	301.0	657.0	131.0	380.0	151.0	1 436.0	100.0	557.0	103.0	1189.0

In the case of wheat on the other hand plant diseases are the second most important cause of damage with insect pests third; the same holds good for potatoes. In the case of barley, hot winds come second as a source of damage, while cotton insect pests occasion almost as much damage on the average as deficient moisture.

Expressed in terms of dollars, the average annual crop damage during the 11-year period was 2620 million dollars, with a minimum of 2054 million dollars in 1912 and a maximum of nearly 3066 million dollars in 1918.

It must however always be remembered that these figures do not represent the actual monetary loss to farmers, but loss due to adverse weather conditions and already taken into account in judging of the expediency of the agricultural undertakings.

**ELIMINATION OR REDUCTION OF RISKS. — Self-Insurance —** One of the best ways of avoiding damage due to bad weather is to avoid monoculture which exposes the farmer to the risk of losing the results of an entire year's work from a single catastrophe. If he invests part of his capital and labour in live stock or in a variety of crops, it is highly improbable that all his sources of revenue or branches of activity will be affected in one and the same year. Many bankers in regions where a one-crop system has prevailed now insist as a condition of granting a loan to the farmer that he shall use a safe-cropping system.

Another way in which the farmer can reduce the risks of crop damage caused by weather is by making a study of the climatic conditions of the region and adjusting the planting, and hence the growing seasons of his crops to the weather. At Grand Rapids, Mich, for instance, the average date of the last killing frost in the spring is May 11, while the average date of the first killing frost in the autumn is about Oct. 8. This gives an average of 150 days without frost. Weather Bureau records further indicate that 5 times in 20 years the date of the last destructive frost in the spring has been 10 or more days later than the average, and that 4 times in 20 years, the date of the first killing frost in the autumn has been 10 or more days earlier than the average. The period absolutely free from severe frosts is thus reduced to a maximum of 130 days. The injurious effects of frosts could be reduced to a considerable extent, if the farmer adjusted his dates of planting to the local climatic conditions and selected the varieties of his seed with due regard to these conditions.

What has been said about frost applies also to drought, excessive moisture and other climatic dangers.

**Contracts of Insurance. —** Tables I and II give a general idea of the risks and losses to which the producer of crops is exposed independently of his skill or forethought. Even after many of these risks have been reduced or eliminated by the principles of self-insurance already mentioned there remains a large element of risk that can only be adequately met by a reliable contract for indemnity, or in other words by insuring the crop. In 1917, the first attempts at crop insurance were made by three joint-stock fire-insurance companies in Montana, North Dakota and South Dakota. The insurance covered all the risks to which

crops are subject, with the exception of fire, floods, "winter-kill" and neglect. Under this insurance, the farmer insures his wheat at 7 dollars per acre. In the case of partial loss, the Company paid for wheat 1 dollar; flax 1.75 dollars; rye 70 cents; and oats, barley and spelt 50 cents a bushel. These first attempts at general crop insurance proved rather disastrous for the Companies that undertook them, owing in part to the severe drought that occurred in large sections of the States named.

In 1920 new crop insurance policies were issued guaranteeing the farmer against frost, "winterkill", flood and drought, damage due to fire, hail, wind, tornado and failure of seed to germinate being excluded. Unlike the 1917 contracts the policy does not place a fixed value on the grain harvested, but provides instead for a valuation on the basis of market price at the time the contract is signed. The Companies were again severely hit in this case because of an unexpectedly heavy fall in prices.

In a third and still more recent type of policy, the amount of insurance to the acre is based on a certain percentage of the average yield during the past 5-year period, this being translated into dollars by assigning to it a value based in the price prevailing during this period.

Thus a farmer, who had averaged during the past 5 years 48 bushels of maize per acre, may be offered insurance for an amount equal to the value of about 36 bushels at the average price for maize during the past 5 years. This form of insurance is certainly more favourable to the Companies than either of the two preceding forms from which it differs in the following important points:

- 1) In the case of total destruction of the insured crops, the Company agrees to pay 75 % of the cost of the field operations actually performed, such indemnity not to exceed 75 % of the total insurance.

- 2) The indemnity shall in no case exceed the actual value of the lost produce.

PRINCIPLES OF CROP INSURANCE. — The author criticises the different forms of insurance and after considering the question from different points of view, summarises his conclusions as follows:

- 1) The insurance must cover only such crop damage as will result in serious financial loss to the farmer. For establishing the reasonable amount of insurance per acre, the average yield and price for a series of past years is perhaps the best basis. Further the acreage of a given crop, if not the entire farm, must be insured as a single unit and adjustment made on the basis of average yield of such acreage. The total loss of crop on one or two acres out of a hundred is not a serious loss, if the acreage as a whole gives average returns.

- 2) The insurance must cover any and all risks which are beyond the farmer's control. Insurance which protects against certain risks and leaves the insured exposed to total loss from others beyond his control is not an effective crop insurance.

- 3) In no case must the insurance protect against loss from carelessness or negligence on the part of the insured. Such protection is

contrary to sound principle and inimical to the best interests, not only of the company, but also of the insured and of the public in general.

4) The premium or cost of insurance must bear a reasonable relation-ship to the value of the protection that it purchases; the expenses item in the expenditures of the insurance organisation should absorb only a small part of the premiums collected, the profits of the Company must be moderate and the bulk of the premiums must be available for the payment of current claims, or accumulated to form a reserve fund for payments in respect of future losses.

5) The method of estimating loss must be such that the insured will receive indemnity for crop damage in such sums as he is led to expect from the figures indicating the amount of insurance per acre.

6) Provision should be made for an early valuation in case of the total failure of an insured crop, or such an approximation to failure that it would not pay to mature and harvest the crop. In all cases, the indemnity should not exceed the value of the labour and other costs, including rental that have been actually lost.

7) All claims involving only partial damage should as far as possible be left until after the crop has been harvested and made ready for market so that the quantity and grade can be determined. G A

371 - **The Control of the Effects of Wind by Means of Plant Wind-Breaks in Tropical America.** — *The Journal of the Board of Agriculture of British Guiana*, Vol. XV, No. 1, pp. 25-26. Demerara, January 1922.

Wind-breaks not only protect plantations from the mechanical action of strong air currents, but also against excessive evaporation and transpiration of the soil and plants, phenomena which are promoted and increased by wind.

The species recommended for wind-breaks in the Antilles and Guiana are those belonging to the genera *Aralia* and *Hibiscus* — *Calophyllum Calaba* ("Galba") — *Mammea americana* — *Eugenia caryophyllata* (clove-plant) — *Swietenia macrophylla* (Honduras Mahogany) — *Mangifera indica* (mango) — *Cinnamomum Camphora* (Camphor) — *Eugenia malaccensis* (jambosa of Malacca).

All these plants make a thick and very high screen, and some of them, such as the camphor tree and clove plant, have also an economic value, while others (*Eugenia malaccensis*, *Mangifera indica*, *Mammea americana*) bear edible fruits. G A.

372 - **Effect of the Length of Day on the Differentiation of Characters of certain Lucerne Varieties and the Possibility of Utilising this Phenomenon as a practical Means of Identification.** — OAKLEY, R. A., and WESTOVER, H. L., in *Journal of Agricultural Research*, Vol. XXI, No. 8, pp. 599-607, pl. 111-121. Washington, July 1921.

When the seed of Peruvian, common Kansas-grown, Grimm and Turkestan lucerne is sown in the early autumn in the approximate lat-

itude of Washington, the seedlings at an early stage develop characteristics that make it easy to distinguish the different varieties from one another

Peruvian lucerne produces erect, sparsely branched seedlings of greater height than the other varieties. They are also more nearly uniform. The Kansas seedlings are very similar to those of the Peruvian variety, but are not nearly so tall and show a greater tendency to send out basal branches.

The Grimm seedlings are still shorter, more branched and less erect. They also showed more variation.

*Medicago falcata* has yellow flowers, very short stems and a rosette-like habit.

Seedlings from spring sowings at Washington or further north, do not develop differences that are apparent to the untrained eye.

At first it was thought that the temperature of the autumn days was responsible for the striking differences shown by the lucerne seedlings, and it was only after the publication of the results of GARNER and ALIARD's work on photoperiodicity that it was thought advisable to make a test experiment for the purpose of determining whether the difference between the autumn and spring seedlings was due to the length of the solar day rather than to temperature.

Three series of small plots were sown on January 20, 1921 with the seed of Peruvian, Kansas, Grimm and Turkistan lucernes, and also with *Medicago falcata*. One series was left under normal conditions. In the case of the second the duration of the day was shortened by placing a light excluding box over the plot from 4 p. m. to 9 a. m. The duration of the light was lengthened for the third series by turning on an incandescent light at dusk and turning it off at 11 p. m.

The seedlings grown under the normal and shortened day behaved essentially like those from sowings made in the autumn. In height the varieties are ranged as follows:

1) Peruvian, 2) Kansas, 3) Grimm, 4) Turkistan, 5) *M. falcata*.

The following are the respective heights of the seedlings as measured on March 3, 1921:

First Series: 1)  $3\frac{2}{3}$  in., 2)  $3\frac{1}{2}$  in.,  $2\frac{1}{2}$  in., 3) 4) 2 in., 5)  $1\frac{1}{4}$  in.

Second Series: 1) 3 in., 2)  $2\frac{1}{2}$  in., 3) 2 in., 4)  $1\frac{2}{3}$  in., 5) 1 in.

On the other hand there are striking differences in the third series, but the behaviour of the varieties is practically the opposite from what it was in series 1 and 2. In fact at the end of the first month, the seedlings of *M. falcata* and Grimm exceeded in height those of the Peruvian and Kansas varieties. They were also erect and unbranched. Their height in inches was as follows: Peruvian 5, Kansas  $4\frac{1}{2}$ , Grimm  $4\frac{4}{5}$ , Turkistan  $4\frac{4}{5}$ , *M. falcata* 5. From these experiments it is clear that it is the day-night relation of lucernes and not their reaction to temperature that causes the development of marked differences between the seedlings of the varieties of lucerne when the seed is sown at certain times of the year.

By properly controlling the duration of lighting, it is possible by this method, and with little trouble or expense to identify the various lots of seed sent for certification

G A

373 **Influence of Light and Temperature on Sexual Expression in Hemp.** — SCHAFFNER, J. R., in *The Botanical Gazette*, Vol. LXXI, No. 3, 197-219, fig. 1, 11 pl. Chicago, Illinois, March 1921

This study was originally undertaken by the author to determine what influence the environment might have on the sex ratio between male and female flowers in hemp (*Cannabis sativa* L.)

**CHARACTERS OF FEMALE PLANT** — Well developed root system; robust stem not so tall as in the male plant; broad, flat crown of leaves; large leaf-blades with more numerous leaflets (5 or more); terminal inflorescence usually leafy, petioles long and robust, female flowers with no vestigial stamens, weight at the beginning of the flowering period nearly twice as great as that of the male plant at the same age, longer growing period

**CHARACTERS OF MALE PLANT** — Small root system, slender spindling habit and greater height due to the very rapid elongation of the internodes just before anthesis, small leaf-blades with fewer leaflets, shorter and more slender petioles, terminal inflorescences with few or no leaves; male flowers with 3-6 sepals (usually 4 or 5), with no vestige of gynoecium, weight about half that of female plant at time of anthesis, much shorter life than that of female plant

Hemp planted in spring in the open, under normal conditions produced pure male and pure female plants without confusion of sexuality in the ratio of about 1:1, with deviations in either direction for various plots.

On the other hand, if the sowing was made in winter, in the greenhouse or on shallow benches with low light intensity, there was great confusion in sexual expression. Abundant irregularities were produced such as stamens with normal stigmas, and structures partly male and partly female, as well as more typically bisporangiate flowers and flowers typical of the opposite sexual state (see Table)

Plot No	Female Plants		Male Plants	
	Pure	Mixed	Pure	Mixed
4	60	54	75	57
5	23	30	19	20
8	25	19	12	29
9	19	24	5	29
10	7	16	13	17
11	2	16	2	11
12	4	32	4	13
13	17	26	9	22
14	20	37	5	18
Totals . . .	167	254	144	216



The percentage of intermediate individuals was much higher in the plantings of the winter of 1919-1920 than in those of the winter 1918-1919. This is apparently due to the fact that in 1919-1920, the plants were sown later (in November and December instead of in January and February), and therefore received the minimum of light. The effect of the physical environment is thus already beginning to show itself in the ratio of sexual expression.

The most interesting point is however the sexual reversion which took place to a large extent; both male and female plants showed reversal in their growing period to the opposite sexual state. In extreme cases over 88 % of the female plants became male, and 80 % of the male plants were transformed into females.

The female plants that are partly intermediate from the first, or afterwards become male, produce normal seed, until the transformation takes place. This reversal takes place at a very advanced stage of development (immediately before or after anthesis until extreme old age), therefore the plant retains its female characters with the sole exception of the flowers.

In sex reversal, some individuals produce only imperfect stamens with defective pollen and indehiscent anthers, while others produce quite normal male flowers.

The reversal is usually less complete in the male than in the female flowers probably because with the males, senility sets in soon after the beginning of anthesis, whereas in the case of the females, there is a long active period after anthesis which permits the environmental factors to have full effect in the growing vegetative tissues.

Plots 11 and 12 shewed the greatest degree of reversal of sex; these plots were situated on the north side of the greenhouse where they received the minimum of light and were kept at a lower temperature.

A few special cases were carefully studied in relation to the progressive change in sexual expression. A certain number of normal females produced 2 or 3 normal seeds and then gradually changed to the staminate condition, until finally they bore male flowers only.

The decided sexual dimorphism exhibited by the sporophyte of the hemp is not due to some homozygous or heterozygous condition, but depends upon the metabolic state of the male and female cells, which can be influenced, especially as regards sex expression, by external agents, particularly by light and temperature.

G. A.

374 - **On Average Soil Temperature.** — EREDIA F, in *La Meteorologia pratica*, Year II, No. 2, pp. 41-46, fig. 1. Montecassino, 1921.

SOIL PHYSICS

EREDIA states, as a result of his study of the determinations made at the "Osservatorio astrofisico" at Catania in the first place, and also of the observations of other authors, that the annual variation in soil temperature may be expressed by a logarithmic equation. Although in temperate regions the depth to which this variation extends is consider-

able, being certainly never less than 10 metres, in tropical countries, as BOUSSINGAULT had already shewn, the upper layers only are thus affected.

Determinations of soil temperature are of the greatest importance, as they furnish data that are very useful especially in botanical research, if taken to the depth of 1 m. Even if made at different times they are of value when coordinated with other observations of the same character, provided that the temperature of the air is determined at the same time as the soil-thermometer is read (1) G A B.

**375 - Soil Temperature and its Effects on the Development of the Nodules of Leguminosae. —** Seen No. 394 of this Review.

**376 - Preparation of Soil Solution. —** GRAYES, I F, and HIRST, C F (Department of Chemistry, Utah Agricultural Experiment Station, Logan, Utah) in *The Journal of Agricultural and Linnæan Chemistry*, Vol XIV, No 3, pp 224-226, bibliography of 23 works Washington, March 1, 1922

In the investigation of 'alkali soils' it is often difficult to obtain a clear filtrate, because in the watery extract the degree of dispersion of the colloidal disperse phase is so great, and in such a stable form, that the solution may be kept for years without flocculation. The particles of such a phase are so small that it is impossible to separate them by ordinary filtration. It is imperative however that the soil extract should be free from colloidal particles, for coloured colloids interfere with the sharpness of the final reaction in colorimetric and some volumetric reactions, and where the colloid is of a protein nature, subsequent reduction may liberate nitrogen or ammonia, which in the final reaction may be interpreted as nitric nitrogen. Further the colloids may actually combine with one or more of the reagents and produce erroneous results.

The ideal method of obtaining a clear aqueous solution would be one which yielded a clear solution without flocculation. This would necessitate the addition of a flocculent which is rapid in action and will remove only a minimum quantity of the soluble salts from the solution without interfering with the sensitiveness of the method. The results of a comparison of the different agents that can be used for this purpose shewed that clear soil extracts may be obtained by adding to 100 gm of soil +500 gm of water 2 gm of lime, ferric sulphate, ferric alum, sodium alum, or potassium alum, and filtering through the Pasteur-Chamberland filter, or centrifuging. The three last processes give a clear solution with a minimum loss of salt. Lime ferric sulphate and ferric alum cause a considerable loss of nitrates. In the determination of chlorides and nitrates nothing is to be gained by agitating the water and soil for more than 5 minutes, provided the soil is finely divided, and the solution vigorously shaken. A longer time of agitation is required in order to reach equilibrium in a soil solution in which sulphates are to be determined and the actual period will depend upon the quantity and quality of the sulphates present.

(1) See R Dec 1921, No 1199 (Ed)

When nitrates are to be determined in the soil solution and alum is used as the flocculent, no other antiseptic is necessary; where alum is not used and the solutions are to stand for some time, it is well to add 0.5 cc. of chloroform to each sample, more concordant results are however obtained when the analyses are made immediately and no antiseptic is used  
G A B.

377 - **Connection between the Hydrogen Ion Concentration of Soils and their Need of Lime.** — JOHNSON, H W (Iowa Agricultural Experiment Station), in *Soil Science*, Vol XIII, No 7, pp 7-22, figs 9, bibliography of 25 works. Baltimore, January 1922

In all the States situated in the wet zone of the United States, the phenomenon of soil acidity occurs, the nature of this acidity is not well understood and very various opinions are held as to its cause. It has been attributed to the presence of mineral or organic acids, to colloidal substances, to adsorption and absorption, and to the effects of specific compounds. More recently, however, the presence of hydrogen ions has been demonstrated and as they are an expression of acid reaction their occurrence denotes real acidity and not a property due to complex theoretical phenomena such as has hitherto been supposed. The presence of hydrogen ions having been proved, their concentration was determined by various authors. These ions may be derived from organic or mineral acids, acid salts, the salts of weak bases and strong acids, compounds which are found in all soils. In any case it is probable that the principal sources of the hydrogen ions of the soil are the acid silicates and the salts of weak bases iron and aluminum. The different views regarding soil acidity resulted in the adoption of different methods for its determination and the results obtained were so dissimilar that their value is doubtful. In some the apparent acidity was taken into account, in others the real acidity or the adsorption acidity, but in every case the results were expressed under the form of the soil's need of lime. As, however the comparative value of want of lime and of the hydrogen ions concentration has not been completely determined, the problem is to ascertain the connection, if any between the need of lime as determined by the various methods and the concentration of the hydrogen ions. If there is any definite connection, the need of lime can be expressed in terms of the hydrogen ions concentration, if no such connection exists, some explanation must be given for the inconsistency of the data relating to want of lime.

In order to decide this question, the author determined the need of lime and the hydrogen ions concentration in 50 very different soils, and found that there is no definite connection between need of lime, as determined by VEITCH's method (neutralisation by lime-water), and the concentration of the hydrogen ions determined by the hydrogen electrode. On the other hand, TRUOG's method (neutralisation by barium hydrate in the presence of carbon dioxide), gives results combining those obtained by VEITCH's method with the data given respecting the concentration of the hydrogen ions

In soils of similar type there is a connection between apparent acidity and real acidity.

The acidity of soils seems to be due to weathering and leaching, rather than to the accumulation of organic acids; the clay particles and the organic matter act as buffers to lessen the concentration of the hydrogen ions which proves that soil acidity is to be attributed to the disintegration and washing away of the mineral substances, and hence to the resultant formation of acid silicates.

To sum up, it is evident that in the generality of soils, the apparent acidity viz., the need of lime, is in no way connected with the real acidity represented by the concentration of the hydrogen ions; this is the case in soils of different types. On the other hand, where the soils are of similar texture, age, formation and organic matter content, there may be a correlation between the two factors.

G. A. B.

378 - **Stratification and Hydrogen-Ion Concentration of the Soil in Relation to Leaching and Plant Succession with Special Reference to Woodlands.** - SALTSBURY F. I., in *The Journal of Ecology*, Vol. IX, No. 2, pp. 220-240 figs. 10. Cambridge, February 24, 1922.

Natural woodlands exhibit a soil stratification in which a definite gradient can be recognised that is reflected in the macro- and micro-organic population. Owing to leaching action, the surface soil is poorest in bases which increase in amount with increasing depth. The organic content on the contrary diminishes with increasing depth associated with which there is a gradient of hydrogen-ion concentration attaining its maximum at the surface. Exceptions are encountered on highly basic soils where the manurial action of the dead foliage may result in a higher base content at the surface than just below the soil. In any case there is a fairly close relation between organic content and real acidity, and "buffer" action (or effect of the latent acidity) is shown to be greatest in the layer of maximum organic content. The view is advanced that woodlands in general and probably all types of undisturbed plant communities in England are tending to become progressively more acid with consequent changes in the character of the vegetation. High forest is most favourable to this succession, while the system of standards-with-coppice with short rotation period tends towards its retardation.

Woodlands occupying valley slopes are inclined to exhibit less marked surface leaching as one descends, and the chief differences between upland and lowland woods are regarded as related to this factor. A depression of vegetative zones related to soil factors is a natural outcome of this process.

G. A. B.

379 - **The Carbon Coefficient for Determining the Organic Matter in Soil.** - READ, J. W., and RIDGELL, R. H. (Arkansas Agricultural Experiment Station), in *Soil Science*, Vol. XIII, No. 1, pp. 1-6, bibliography of 9 works. Baltimore, January 1922.

The researches of SCHULZE, WOLFF, FRESSENIUS and van BEMMELEN have contributed to extend the use of a conventional coefficient for estimating the organic matter content of soils from the amount of organic

carbon they contain. The value of this method has however been called in question on several occasions, and the author's work furnishes some conclusive evidence on the subject.

He determined the organic carbon present in 37 typical soils (superficial, and sub-superficial, subsoil), from various North American Experiment Stations; the determination of the organic carbon was effected at the same time as that of the organic matter and by means of a special rapid method of dry combustion.

The data obtained proved without exception that the coefficient 1.724 adopted in the belief that the humus contained 58 % of carbon, gives lower results than those obtained by direct determination. In fact, the carbon percentage of the organic matter present in the superficial layer of the soils examined varied from 30.20 to 56.27 %, with an average of 49.26 %, being less by 9 than the percentage obtained by means of the coefficient. In the case of the subsoil, the difference was even greater, the average amount of carbon in the organic matter being hardly 39.16. There is thus every reason to doubt the expediency of adopting an arbitrary coefficient for the carbon content of the organic substances found in the soil. In any case, more accurate results could be obtained by choosing a coefficient based upon a probable carbon content of 50-52 %.

G A B.

- 380—**Studies on *Clostridium Pastorianum* as a Fixer of Nitrogen.**—I TRUFFAUT, G., and BEZSSONOFF, N., Augmentation du Nombre des *Clostridium Pastorianum* (Winogradski) dans les terres partiellement stérilisées par le sulfure de calcium, in *Comptes rendus de l'Académie des Sciences*, Vol CLXXII, No 21, pp 1319-1324. Paris, May 23, 1921.  
— II ID ID Sur les variations d'énergie du *Clostridium Pastorianum* comme fixateur d'azote, *Ibidem*, Vol CLXXIII, No 19, pp 865-870, November 7, 1921.

The effect of partial sterilisation, whether by heat or an agent with a calcium sulphide base, is proved by the fact that, out of 10 tubes of agar mixed with glucose and sown with control soil solution, only 3 fermented, although in the case of the same number of tubes containing partially sterilised soil, 8 underwent butyric fermentation even 8 days after treatment; after 16 days the ratio still remained as 1 to 2. Adopting the dilution method, the number of *Clostridium* per gram was about 100 000, but this figure is far below the real one. Even if it is accepted, it is from 10 to 100 times higher than the figures given by JONES and MURDOCH in the case of *Azotobacter*. The highest counts of these two authors give 1800 organisms per gram, whereas TRUFFAUT and BEZSSONOFF were only able to find 500. It would thus appear that (*Clostridium Pastorianum*, and not *Azotobacter*, is the principal agent of the fixation of nitrogen in the soil.

II. — The authors made 2 other experiments by partially sterilising a normal soil and making successive cultures from it. They consider themselves justified in drawing the following conclusions from the results obtained:

- 1) The partial sterilisation of the soil by means of calcium sulphide not only increases the number of the *Clostridium Pastorianum* in-

dividuals, but also their capacity for fixing nitrogen. This stimulating effect of partial sterilisation is lost after repeated culture in agar mixed with glucose.

2) There is in soil a factor that hinders the growth of *Clostridium* in artificial cultures made with it. The effect of this factor becomes imperceptible when these cultures are sown with dilutions of about 1/100 000.

G. A. B.

DRAINAGE  
AND  
IRRIGATION

381 - Irrigation Schemes in the Niger territory of the French Soudan. — See n° 417 of this Review.

382 - The Improvement of Arable Land and Meadows in Czecho-Slovakia. — *Bulletin of the Ministry of Agriculture of the Republic of Czecho-Slovakia*, Year III, No 1, pp. 1-2 Prague, January 1, 1922 (1)

Stock-breeding being the most important branch of Agriculture in the Czecho-Slovakian countries, meadow land is of equal importance with arable. According to statistics, there were in 1920 520 791 hectares of meadow land in Bohemia, 154 982 hectares in Moravia and 30 028 hectares in Silesia, the hay crop was 31 6 quintals per hectare in Bohemia, 29.4 quintals in Moravia and 18 3 quintals in Silesia. The average hay crop is much less than in Germany as the land has not as yet been sufficiently improved. The largest yield per hectare is in the Czecho-Moravian mountains, next come the crops of the Forest of Bohemia (Sumava), and of the Sudetes. The total hay production of Bohemia in 1909 was 16 500 000 quintals, with a value of 136 millions of crowns.

The land improvement works are subsidised by the State and the Local Administrations, the latter having opened Land Improvement Colleges with the object of training the necessary staff. There are 2 such colleges in Bohemia the course lasting for 2 years. One of the Colleges is at Vysoké Myto and the other at Cheb. In Moravia, there is a third College at Roznov. These Colleges are provided with all the means of instruction, collections and laboratories, a botanic garden, experiment fields and a large experiment farm. The students are chiefly instructed in the science of improving fields and meadows, that is to say, drainage work, constructing irrigation and hydraulic works, aqueducts, road-making and land division etc. After completing their course the students are found posts on the staff of the Provincial Agricultural Councils, in Cooperative Societies for land-improvement, or are employed by Agricultural-engineers in charge of hydraulic works, in some cases they are authorised to carry out less important work on their own responsibility.

The Ministry of Agriculture makes a grant for the improvement of pastures. The neglected grazing-grounds of the Bohemian Forest have been taken in hand with the result that the returns have been increased by 3 million crowns.

The principal means by which the forage crops are increased is by carrying out drainage or irrigation works, or both simultaneously.

(1) See R Dec. 1921, No 1191 (Ed)

Since 1908, an increased development of hydraulic works can be observed. As the duties of the Bureau of Hydraulic Operations, attached to the Council of Agriculture in Prague were continually increasing, branch offices have been opened at Chlumec n. C., Králové, Hradec, Kutná Hora, Hostelec n. O., Velvary and at Soběslav (for the improvement of peat-moors). The impetus that has been given to improvement works in Bohemia is shown by the Statistics for the improvement of arable land and meadows, which give the total superficial area improved between 1885 and 1907 as 35 384 hectares, and the expense of the respective operations as 35 293 000 crowns.

Owing to the improvement of the meadows, the yield per hectare has risen to 50 quintals of hay, and when all the meadows of Bohemia have been improved, the value of the total hay crop will rise from 136 438 crowns (1905), to 71 700 000 crowns. The area of meadow land that has deteriorated from excessive moisture is reckoned at 500 000 hectares, not counting the peat-moors which cover 20 000 hectares.

In Bohemia, as in all the other Provinces, the improvement operations have passed by successive stages from open ditches to pipes buried in the ground. The drainage system is known by different names, according to the materials employed for the work, stones, wood, rods, bricks and pipes.

The improvement work is carried out under the supervision of the Improvement Cooperative Societies which are established in accordance with a law giving them a right to the grants made for the purpose by the State and Provincial Administrative Authorities. These Cooperatives are united in a Confederation at Prague.

Peat-moors are very common in the mountains: the Bohemian Forest, Sudetes, Czecho-Moravian mountains, the neighbourhood of Třeboň, and Blatná and in the basins of the rivers Labe and Jizera.

The improvement of the peat-moors would result in a profit of 6 million crowns. In Bohemia, they are cultivated according to the methods employed in Germany, the Netherlands etc. There are also several factories in Bohemia (Stráž, Nové Hradky and Bastianberg), where excellent peat-moss litter is made.

In the 1922 Budget of the Ministry of Agriculture of the Czecho-Slovakian Republic, the sums allocated to land improvement amount to 23 900 000 crowns; in the Budget of Bohemia, 4 480 000 crowns were set apart for this purpose as against 5 230 000 crowns in Moravia and 64 672 crowns in Silesia.

G. A. B.

383 - **Further Experiments with Activated Sludge in England.** — RICHARDS, E. H. and SAWYER G. C. (Rothamsted Experimental Station), in *Journal of the Society of Chemical Industry*, Vol. XLI, No. 5, pp. 62-70. London, March 15, 1922.

MANURES  
AND  
MANURING

Preliminary experiments carried out at Rothamsted on the fertilising value of slate-bed and activated-sewage sludge have recently been described (1). The present communication deals more particularly with

(1) See R. 1920, No. 843. (Ed.)

attempts to answer the following questions : 1) Does the activated sludge method recover more of the nitrogen in sewage than the older methods of sewage purification ? 2) Is the nitrogen recovered in the sludge in a form available as plant food ? 3) What is the source of the high nitrogen content of activated sludge ? The enquiry was undertaken at the request of the Ministry of Agriculture, most of the expenses being met by a grant from the funds of the Ministry. In order to test the fertilising value of activated sludge on the field scale and at the same time to obtain information on these points, it was desirable to have a small plant working under direct control and concurrently with the laboratory experiments.

The results of these experiments may be summarised as follows.

1) If activated sludge is aerated for a short period in an ammoniacal solution, the recovery of the nitrogen is quantitative. The nitrogen not found as ammonia or nitrate in the effluent is recovered in the sludge.

2) If aeration is continued, loss of nitrogen occurs and this loss is roughly inversely proportionate to the volume of sewage present.

3) The same effects are observed with sewage. The ammonia falls, while the sludge gains nitrogen with a loss of nitrogen on the whole balance after 16 days' operations.

4) There is considerable evidence to shew that the extra nitrogen in activated sludge, over and above that found in the old type sludges, is derived from the ammonia of sewage. There is no evidence of fixation of atmospheric nitrogen.

5) The number of protozoa in well-activated sludge approximate to 1 000 000 per gram of wet sludge. The cell content of these organisms alone may account for a large proportion of the extra nitrogen.

6) There is complete correlation between the numbers of active protozoa and bacteria in activated sludge under varied conditions of working.

7) The increase in bacterial numbers following suppression of the protozoa produces no improvement in purification of sewage. There is, however, a change in the bacterial flora, nitrifying organisms being suppressed by the partial sterilisation. When nitrifying organisms were reintroduced, a greater quantity of nitrate was found in the partially sterilised than in the untreated sewage. The experiments did not, however, enable the investigators to decide whether this is due to larger production or a decreased destruction of nitrate.

Simultaneous experiments carried out at the experimental sewage plant, in which a domestic sewage of rather above average strength and a small proportion of detritus were used, resulted in the production of activated sludge containing 3.5 to 6.8 % of nitrogen calculated on the dried sludge. Very great variations in the methods of working (e.g. in the volume of air, strength of sewage, amount of sludge in tank, and time of retention), produce no appreciable change in the nitrogen content of the sludge. Observations made in working the experiment tank confirm the laboratory experiments designed to find the source of the extra nitrogen content of activated sludge compared with ordinary sewage sludges. They



afford no evidence of fixation of atmospheric nitrogen, but suggest that, in addition to colloidal nitrogen, ammonia is removed from the sewage by physical or biological means or both. Under strongly aerobic conditions, and with a less proportion of sludge in the tank (less than 25 %), the recovery of sludge is practically quantitative (colloids neglected), i. e., its weight is practically the same as the weight of suspended solids in the sewage. If aeration is moderate to poor, and if the volume of sludge is allowed to accumulate up to 50 % or more, over half the dry matter in the suspended solids of the sewage disappears. Variations of conditions influence the nitrogen changes in a similar way, but there is always a loss of nitrogen — under favourable conditions 20 %, under unfavourable 80 % of the nitrogen left in the tank is not recovered.

The proportion of total nitrogen recovered from sewage in normal working by the activated sludge method is greater than by the older methods of sewage purification, viz 15 % compared with 10 % obtained by precipitation and 4 % by septic tanks. With sewage of half the average strength and supplying twice the normal volume of air per gallon of sewage, the recovery of nitrogen was 27 % of the total nitrogen in the sewage.

The tank experiments also brought out 2 other important points  
a) the great increase in availability of the nitrogen by activation, under continuously aerobic conditions 66 % of the total nitrogen is nitrified in 100 days (under less aerobic conditions only 40 % of the nitrogen in the activated sludge is nitrified), compared with 15 % of sewage solids, and if the latter had been lagoon-dried, probably not more than 5 % of the nitrogen would have been available.

The phosphoric acid content of samples of activated sludge is much higher than that found in the old type sewage sludges examined by the Royal Commission (1). These contained from 0.66 to 1.11 % phosphoric acid compared with 2.8 to 3.8 % in activated sludge. The same applies, but in a less degree, to the potash. The amounts of phosphoric acid and of potash have not much manurial importance, but their relation to the high nitrogen content of activated sludge is suggestive of a common biological origin.

Field trials were made with activated sludge at Rothamsted Farm, the first lot was applied to plots for grass and barley, the second for potatoes. No attempt was made to dry the sludges beyond about 90 % moisture content, and they were applied in a pasty condition which made uniform distribution rather difficult. The results obtained showed that generally speaking, activated sludge gave good yields in comparison with sulphate of ammonia and farmyard manure, the nitrogen ratios being equal. It must be remembered that rather less than half the nitrogen in the activated sludge is available in 100 days, while practically the whole of that in the sulphate of ammonia can be nitrified in the time. There is one important difference between the results of these field trials and those ob-

(1) See R 1015, No. 795. (Ed.)

tained in the preliminary pot-culture experiments, described in the beginning of the article. The dried sludge gave very uniform results in pots, but the wet sludge gave much greater differences between the yields of individual plots than is usual in this class of work. This effect was noticeable with all 3 crops, but no satisfactory explanation can be given to account for the bad agreements between duplicate plots. In any case, however, these field trials show that activated sludge has a high manurial value in marked contrast with the old type sewage sludges tested on the Rothamsted farm in past years

G. A. B.

384 - Experiments with "Rhenania Phosphat" in Germany. — REMY, Th and WEISKE, F (Aus dem Institut für Bodenlehre und Pflanzenbau an der Landwirtschaft Hochschule in Bonn-Poppelsdorf), in *Landwirtschaftliche Jahrbücher*, Vol LVI, No 1 pp 1-57 Berlin, 1921

The authors have continued their manurial experiments with "Rhenania phosphat" (1) which is obtained by calcining a mixture of phonolite and crude, poor phosphates rich in lime. Six years have elapsed since the first researches were made without any attempt at experiments on a sufficiently large scale. The experiments made in Belgium with a similar product known as "Vesta" phosphate (2) gave excellent results on the whole as compared with those obtained by the use of either superphosphate or basic slag. In the opinion of GRÉGOIRE, "Vesta" phosphate has also an energetic fertilising action, and it would appear that its phosphoric acid and potassium are quite as readily assimilated as that of basic slag and the potassium of the potassic salts used as fertilisers respectively.

The authors undertook 2 series of experiments, one to test the action of "Rhenania phosphat" in the capacity of a phosphatic fertiliser, and the other to determine its action as a potassic fertiliser. They adopted the following methods:

1) Except in special cases, they always compared equal quantities of the total phosphoric acid.

2) They always compared the potash of "Rhenaniaphosphat" with a parallel series of leucitic potash obtained by the fusion of lime with leucotephrite.

3) Since "Rhenania phosphat" and basic slag both contain basic lime, the authors took into account the amount of the lime in the above-mentioned products.

4) The potassic fertiliser was always spread before sowing and mixed with the upper 30 cm of soil.

5) The basic fertiliser on the contrary was applied in successive doses.

The experiments were carried out in pots with an artificial soil made by mixing clay with quartz sand, peat, calcium carbonate and ground phonolite. The plants chiefly grown were *Cruciferae* (as being very susceptible to phosphatic fertilisers), hairy vetch, tobacco and potatoes.

(1) See R 1916, No 496 (Fd)

(2) See R 1919, No 572 (Ed)

The following conclusions may be drawn from the results obtained :

a) Approximate equivalence of the phosphoric acid soluble in citric acid present in " Rhenaniaphosphat " and basic slag in 6 out of 10 experiments.

b) The action of the total phosphoric acid of basic slag and of " Rhenaniaphosphat " was equal in 3 out of the 13 cases mentioned.

c) In 4 cases the action of total phosphoric acid of " Rhenaniaphosphat " was greater than that of the phosphoric acid in basic slag.

In 40 % of the cases, the action of the phosphoric acid of " Rhenaniaphosphat " corresponded to its solubility in citric acid ; on the other hand, it was greater in 60 % of the cases. This difference in the results depends partly upon the intimate composition of the fertilisers compared and partly on external circumstances.

In the experiments relating to potassium, it was found that it was used in the proportion of 47 to 100 % (average 73 %), of the corresponding value in potassium of potassium chloride. It may safely be said, that the potassium of " Rhenania-phosphat " corresponds to 81 % of an equal amount of potassium in the form of potassium chloride and sulphate. Owing however to the method of manufacture the availability of the potassium decreases as the action of the phosphoric acid increases, but this has only a secondary effect on the total results, because a " Rhenania-phosphat " containing 12 % total phosphoric acid and 3 % potassium would be worth per quintal 60 marks for the phosphoric acid and 1.50 to 2 marks for the potassium, so that the latter becomes a gratuitous supplement to the phosphoric acid.

As regards solubility in citric acid, the phosphoric acid of " Rhenaniaphosphat " would seem inferior to that of basic slag. There is, however, no strict proportionality between this solubility and the fertilising power of phosphoric acid, and no results could be obtained from researches in this direction.

G. A. B.

385 - **Results of Two Years Experiments with Superphosphate " Tetraphosphate " and Phosphorite in Italy.** -- AVANZI E. (Istituto Agrario della R. Università di Pisa, in *L'Agricoltura Italiana*, Year XLIV, Parts 1-5, pp. 145-155, Bibliography, Pisa, 1921 (1).

These experiments were undertaken with the object of making some contribution to the much discussed question of the efficacy of " tetraphosphate " as compared with mineral superphosphate and phosphorite. They were carried out in two adjoining fields divided into 8 plots. Maize was grown in the fields in 1918, and winter wheat in 1918-1919 ; the maize succeeded a temporary winter pasture fertilised with farmyard manure ; the wheat had been manured with nitrate of soda. The total phosphoric acid content of the superphosphate used was 15.10 %, of which 14.65 % was soluble in water and citrate of ammonium. The tetraphosphate was found by analysis to contain 26.22 % phosphoric acid of which 1.68 % was soluble in 1 % citric acid, while the phosphorite contained respective-

(1) See R. 1920, No. 498. (Ed.)

ly 26.70 and 2.12 % ; both the latter compounds were equally finely ground. The phosphatic fertilisers were applied to the maize at the rate of 4 quintals per hectare in the case of all except the control plots.

In the following table the author gives a summary of the results obtained. He calculates the yield indices from the average weight of the crops obtained from the control plots and brought up to 100.

Fertilisers	Maize (1st year)		Wheat (2nd year)	
	Grain	By-products	Grain	By-products (straw and grass)
None (control). . . . .	100	100	100	100
Phosphorite . . . . .	100	101	101	100
Tetraphosphate . . . . .	109	108	105	105
Mineral superphosphate . . . . .	120	112	112	106

In order to be able to estimate these results accurately, it must be understood that the productive capacity of the land was high, owing to manuring and working in the preceding years. Hence none of the differences are observed which would occur in the case of soils that had never been fertilised. The differences between the effects of the fertilisers applied are however so noticeable that the following conclusions can be justified.

- 1) The phosphorite had no appreciable effect upon either the first or the second crop.
- 2) The tetraphosphate exerted a beneficial effect upon both the first and the second crop.
- 3) The action of the tetraphosphate upon both crops was less than that of the mineral superphosphate, although the latter had a considerably lower phosphoric acid content. Further, as the difference in the price of the phosphoric acid unit was not proportional to the difference in the efficacy of the two fertilisers, the inferiority of the tetraphosphate is absolute.

Two points still remain to be decided : *a*) whether under other conditions tetraphosphate would behave differently as compared with superphosphate and phosphorite ; *b*) the efficacy of tetraphosphate as compared with basic slag. When these points are settled, it will be necessary to consider the economic aspect of the question.

In any case in order to arrive at some definite conclusion respecting the desirability of using phosphorites, and the superiority of one phosphatic fertiliser over another, it would be advisable to carry out further experiments with the object of comparing one or more ground phosphorites with superphosphates, and more particularly with the tetraphosphates obtained from each phosphorite.

G. A. B.

386 - **Studies on Sulphur as a Factor in Soil Fertility.** — I WOODWARD, J (Contributions from the Hull Botanical Laboratory 289), in *The Botanical Gazette*, Vol LXXIII, No 2, pp 81-100, bibliography of 73 works. Chicago Ill., February 1922 — II BUSANELLI, L. S. (Chief Chemist, Iseopet Sulphur Company), A Historical Review of the Research showing the Fertiliser Value of Sulphur in *The American Fertiliser*, Vol LVI No 4, pp 80-86 Philadelphia February 25, 1922.

I — This investigation was conducted under the terms of a research fellowship from the Gypsum Industries Association in the United States. Basing his opinion on the analyses made by ROBINSON (1) which show a wide variation in the sulphur content of different soil types the author considers that other types of soil should be analysed to discover their sulphur as well as their phosphorus content and that it is also necessary to conduct field experiments. He therefore analysed 34 average soil and sub soil samples from Indiana Kentucky Michigan Ohio and Wisconsin for phosphorus sulphur and the loss on ignition. Fertilising experiments with gypsum were made at the same time in the field of Indiana and Kentucky whence the samples had been taken.

The analytic data show a general relation between the sulphur content and the loss on ignition in soil samples of the same or closely related soil types but this relation is not apparent when different soil types are compared. The sulphur contents in the surface soil vary from 0.0118 to 0.0905 per cent while the phosphorus contents vary from 0.0360 to 0.3407 per cent. All the upland and most of the alluvial soils are poor in sulphur the high phosphorus content of most of the Kentucky soils and one of the Indiana soils is undoubtedly due to the influence of the rock from which they were derived this being the case with the Kentucky samples a limestone rich in phosphorus. If the sulphur and phosphorus content of the surface soil (the upper 15 cm) are calculated and compared with the amounts removed by maximum crops of maize wheat timothy clover and lucerne it is found that the highest sulphur content is sufficient for only 39 years of lucerne 139 of clover 159 of timothy 355 of wheat or 232 of maize whereas the lowest sulphur content is sufficient for only 5 years of lucerne 18 of clover 21 of timothy 46 of wheat or 30 of maize. The lowest phosphorus content is equal to the amount removed by 42 years of maize 60 of wheat 80 of timothy 36 of clover or 20 of lucerne. On the other hand the maximum phosphorus content would be enough for 401 years of maize 568 of wheat 757 of timothy 341 of clover or 189 of lucerne.

On some of the soils tobacco clover and lucerne were benefited by the use of gypsum. The results are however not quantitative. More field experiments are needed and greater care should be taken to eliminate other factors interfering with the effect of the gypsum. Each treatment should be repeated in order to reduce the probable error. More satisfactory results would probably be obtained if the work were confined to one field for each soil type and if each treatment were applied to from 3 to 5 plots in the same field.

(1) See *R. I. I.*, No 11 (14)

II. — The author reviews the literature (especially the American literature), dealing with the question of the fertilising value of sulphur and reminds the reader that much less is known about the transformations of sulphur in the soil than about those of nitrogen. The reason is that sulphur is very rarely deficient in soils, and the subject has never been considered of sufficient practical importance to justify extensive investigations.

Instead of thinking of the nitrogen-phosphorus-potash formula as representing a complete fertiliser, it is time to work solely from the standpoint of limiting factors including not only the three above-mentioned, but also sulphur, lime, magnesium and any other factors that influence crop production.

The early failures with gypsum were probably due to the fact that phosphorus or some other element besides sulphur was limiting growth, or that sulphur was not the element required. In any case, the facts recently brought out in regard to sulphur should lead at once to a widespread re-examination of these problems with more carefully designed and more rigidly controlled experiments.

G. A. B.

AGRICULTURAL  
BOTANY.  
CHEMISTRY  
AND  
PHYSIOLOGY  
OF PLANTS

387 — **Differentiation of Character in Young Lucerne in Relation to Length of Daylight.**

— See No. 377 of this *Review*

388 — **Sexual Expression in Hemp in Relation to Light and Temperature.** — See No. 377 of this *Review*

389 — **Chemical Composition of Green Maize at different Stages of Ripening.** — See No. 408 of this *Review*

390 — **Occurrence of Quercetin in a Type of Brown-Husked Maize.** — SANDO, C. E. (Junior Chemist, Office of Physiological and Fermentation Investigations, Bureau of Plant Industry, U. S. Depart. of Agric.) and BARTLETT, H. H. (Department of Botany, University of Michigan, Collaborator, Office of Physiological and Fermentation Investigations, Bureau of Plant Industries, U. S. Depart. of Agric.), in *Journal of Agricultural Research*, Vol. XXIII, No. 1 pp. 1-4. Washington, 1921.

In connection with the genetical studies of pigmentation in maize, which have been carried on for several years at Cornell University, the authors made parallel biochemical studies in the isolation and identification of the pigments from material of known genetical constitution. The brown-husked type of maize contains a flavonol viz., free quercetin, and a quercetin glucosid.

The two compounds are both lemon-yellow in colour. If they account for the truly brown colour of the husks of this type, it must be through their tinctorial quality, probably through their adsorption on some colloid component of the brown tissues. It is very probable that the quercetin glucosid is the counterpart in the brown type of the anthocyanin of the purple type of which the pigment will probably be found to be allied to cyanin.

G. A. B.

391 - **Composition of Wild Beets.** — SAILLARD, E., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXXIV, No. 6, pp. 411-412. Paris, February 6, 1922.

The author gives the results of the analysis of two lots of beetroots coming from Primel-Trégastel (Finisterre), and forwarded to him at the request of SCHRIBAUX. The data obtained may prove useful to the breeder who is seeking for roots specially adapted to industrial requirements and capable of transmitting their characters.

*Consignment of October 26.*

	Average	Maximum	Minimum
Weight of roots . . . . .	17 gm.	56 gm.	10.80 gm.
Dry matter . . . . .	32.18 %	35.22 %	29.64 %
Sugar . . . . .	15.95	19.60	13.80
Ash . . . . .	1.73	1.98	1.32
Insoluble pulp . . . . .	9.12	10.48	7.24
Carbonised ash in the residuum . . . . .	0.46	0.56	0.20
Nitrogen . . . . .	0.84	0.98	0.63
Water + sugar . . . . .	83.50	84.38	82.88

These beets, which are smaller and more woody than the beets used in sugar manufacture, also contain more dry matter, as well as more insoluble pulp, more total nitrogen, more mineral substances (about 2 ½ times as much), and more chlorine, sodium, magnesium, and phosphoric acid.

Their sugar content is equal to or higher than the sugar content of the industrial beets; their sap is less pure and the sum water + sugar lower.

*Consignment of December 14.*

Sugar . . . . .	13.00 to 15.56 %
Dry matter . . . . .	26.40 to 28.40
Carbonised ash . . . . .	0.98 to 1.28
Total nitrogen . . . . .	0.33 to 0.49
Insoluble pulp . . . . .	9.00 to 9.90
Carbonised ash per 100 of residuum . . . . .	0.34 to 0.40

The figures obtained from this consignment were thus lower than in the case of the first.

These results show that wild beets can be found with as high a sugar content as cultivated beets grown for industrial purposes P. C.

392 - **Formation of Alkaloids in Belladonna Leaves, in Relation to Solar Radiation.**

— See No. 429 of this Review.

- 393 - **The Influence of Light and of Fluctuating Temperatures on the Germination of *Poa compressa*.** — FRYER, J. R. (Department of Field Husbandry, University of Alberta), in *Scientific Agriculture*, Vol. II, No. 7, pp. 225-230, figs. 5. Gardenvale, P. Q., March 1922.

It has been observed that the satisfactory germination of *Poa compressa* L. is more or less uncertain. In samples, which on external examination, appeared to be full of life, sometimes only 10 to 20 % of the seeds germinated, whereas for other samples of similar appearance the germination percentage rose to 50 or 60 %. Moreover the same samples, when retested, frequently gave results differing widely from those obtained the first time. General observations led to the belief that sunlight and fluctuating temperatures were beneficial to the germination of this seed, but no definite data had been obtained and no literature dealing with the subject was available.

The author made an experiment on the influence of sunlight upon the germination of Canada Blue Grass (*Poa Compressa* L.), and took 12 seed samples for the purpose. Simultaneously with the above tests another experiment was conducted for the purpose of studying the effect of steady temperatures and of fluctuating temperatures. The results showed that sunlight has a somewhat beneficial effect upon the germination of *Poa compressa*. Daily fluctuations of temperature ranging between 15° C and 35° C are probably the best temperature conditions for germination.

G. A. B.

- 394 - **Effect of Soil Temperature upon the Development of Nodules on the Roots of certain Leguminosae.** — JONES, F. R. (Pathologist, Office of Cotton, Truck and Forage Disease Investigations, Bureau of Plant Industry, U. S. Dept. of Agric.) and TISDALE, W. B. (Instructor in Plant Pathology, University of Wisconsin), in *Journal of Agricultural Research* Vol XXII No 1, pp 17-31, figs. 4, pl 3. Washington, 1921

The study of a diseased crop of lucerne suggested the idea that soil temperature might affect the development of nodules on the roots of lucerne and perhaps all other leguminosae to such a degree that the assimilation of nitrogen by these plants is greatly modified during the summer. The researches described in this article were carried out with the object of investigating the question. Preliminary studies were made upon the effect of soil temperature on the development of 4 leguminosae; lucerne, red clover, field-peas and soy-beans with special reference to its effect on the infection of these plants by *Bacillus radicicola* Beijer., and the subsequent development of nodules. The greater number of the data were obtained by growing plants in soil kept at a series of temperatures, ranging from 12° to 36° C with variations of 3° between each. The air temperature was uniform for all the plants, ranging from 14° to 20° C.

As was anticipated, the 4 plants differed in their ability to tolerate soil temperatures at the extremes of the series. Thus peas were dwarfed at 30° C; clover developed poorly at 36° C while lucerne and soy-beans grew very well at that temperature. Soy-bean plants grown in soils kept at 12° — 15° — 33° — 36° C had very dark-green leaves, whereas the foliage



of those towards the centre of the series became progressively lighter, the lightest leaves being found at 24° C

With regard to the number of nodules formed on plants grown in soil kept at these series of temperatures, irregularities were found in each series, but no large and consistent differences were discovered, except that at the extreme upper and lower temperature limits tolerated by the plant the number of nodules was reduced, although peas usually produced a greatly increased number of nodules at 30° C. In short all the species studied form nodules in soils at any temperature at which the plant can make a growth that is at all vigorous

While the variation in the number of nodules was not consistent their size measured by the average dry weight per plant was found to differ greatly and consistently within the series at least so far as the soy-bean was concerned. The maximum weight attained for a soy-bean plant after a period of two months was found at a soil temperature of 24° C. Examination of nodules on the roots of the other Leguminosae indicated that their maximum production occurred at about the same temperature

The weight of the nodules produced by soy-beans was not found to be correlated with the weight of tops or roots through the series of temperatures. In fact the weight of the tops was practically as great at 30° to 36° C as at 24° C while the weight of the roots declined rapidly at the higher temperatures. The weight of the roots likewise showed no such diminution at the higher or lower temperature as did the weight of nodules. With the soy-bean plant and to a much less marked degree with the other plants there was a correlation between weight of nodules and colour of plants, the largest weight of nodules occurring on plants with the palest green colour. Generally speaking, plants with large nodules had a higher percentage of total nitrogen in the tops though this correlation is not exact

As regards the factors of soil environment that may exert an influence upon nodule formation such as moisture, concentration of nitrates and hydrogen-ion concentration of the soil solution it does not appear that their variations, influenced in any way the differences in nodule development recorded at the different temperatures in these series. G A B

395 - Observations on Heredity made at the Phytotechnical Station at Abed (Denmark). VIELERGAARD H A B in *Zeitschrift für Pflanzenzuchtun* Vol VIII Part pp 19-115 Berlin, September 1921

PLANT  
BREEDING

A series of experiments on lupin, wheat and barley have recently been carried out at the Phytotechnical Station of Abed (Denmark). The following are some of the results obtained

1) LUPIN - *Lupinus angustifolius* is a blue-flowered variety but contains individuals having both red and white flowers

From the cross *white* × *blue* were obtained in the  $F_1$  exclusively blue-flowered individuals, and in the  $F_1$  blue and white offspring in the ratio of 3 : 1. From the cross *red* × *blue*, blue-flowered hybrids were obtained in the  $F_1$ , and in the  $F_2$  blue and red-flowered plants in the ratio of 3 : 1

The *blue* × *red* cross gave in  $F_1$ , blue individuals and in the  $F_2$ , blue, red and white flowered plants in the ration of : 9 : 3 : 4.

There would appear to be two genetic factors concerned, B and R, in the case of the blue flowers ; B by itself gives rise to white flowers, and R to red flowers.

2) BARLEY. — In 1916, there appeared in a line of native barley, No. 867, eight abnormal plants characterised not only by their stiff straw but also by having only 6-7 very closely growing grains situated at the tip of the ear. These seeds were sown ; 36 abnormal and 4 normal plants being obtained ; the abnormal produced in their turn (in 1918) abnormal progeny only, whereas the offspring of the normal plants consisted of normal and abnormal individuals in the ratio of : 3.35 : 1.

The anomaly was probably the result of mutation in a 1914 plant, but owing to the dominance of the normal type, it only came to the light in 1916 as a consequence of segregation.

3) WHEAT. — As a result probably of mutation, a speltoid type of wheat was discovered in a line of wheat known under the name of Abed Storalks (large-eared Abed), and derived from Square-head. The new type differed from the original line in having longer, weaker culms, and longer, thinner and less dense ears. The progeny of the mutant was composed of speltoid and of normal types in the proportion 1 : 1. The normal plants produced exclusively normal descendants, whereas the speltoid continued to segregate into normal and speltoid individuals in the proportion 1 : 1, and may give rise to new types. In this way amongst others a dwarf form and an awned speltoid form have been obtained.

G. A.

396 - **The Establishment of a New Vine Selection Station in Austria.** — *Zeitschrift für Pflanzenzüchtung*, Vol VIII, Part. 2, p. 208 Berlin, September 1921.

The Austrian Ministry of Agriculture and Sylviculture has established at Klosterneuburg, near Vienna, a Rebenzüchtungsstation (Vine Selection Station) which is attached to the "Höhere Staatslehranstalt für Wein und Obstbau" (Advanced School of Vine-Growing and Fruit-Tree Growing). The new institution has been placed under the scientific direction of Dr. LINSBAUER, the administration having been entrusted to Fr. KOBER, Inspector General of Viticulture.

G. A.

397 - **Experiments in Selection and Hybridisation made with the object of obtaining Types of Oats for Norrland (North Sweden).** — NILSSON-EHLE, H., in *Sveriges Utsädesförening s Tidsskrift*, Year XXXI, Part 5, pp. 200-215. Malmö, 1921.

In Sweden owing to high latitude and varying altitudes, there are great differences in the climates of the physiographical zones ; it is therefore necessary, in the case of every species of agricultural plant, to obtain distinct types specially adapted to each zone. This fact was recognised from the beginning of plant-breeding and selection in the country. Early maturing kinds of oats must be chosen for Norrland in order that the crop may ripen before the first autumn frosts. The species of oats indigenous to this region have succeeded in the course of time in adapting themselves

to their northern environment with its short summers and small sum total of heat. They ripened much earlier in the comparative cultural experiments than the varieties from districts lying further south. These native oats of North Sweden, although differing greatly from one another in many of their characters, share the following defects: low yield; poor quality of grain (the caryopsids are small and the glumes form a high percentage) weak straw.

There are 3 varieties:

1) *Nordsvenska hvithafren* (White Oats of North Sweden), very early, grown in South and Central Norrland;

2) *Nordfinsk svarthafren* (Black Oats of North Finland), very early, grown in Upper Norrland.

3) *Meröhafren* (Meroe Oats), native Norwegian oats of Meroe in the Nordlanden

Two other very early varieties, *Mesdag* and *Tyskmosshafre* have recently been widely grown in Northern Sweden

The cultural experiments made at Svalöf have demonstrated the yielding capacity of the early types. Guldregn produces a crop from 30 to 40 % higher on an average than Mesdag and Nordfinsk. There is therefore nothing surprising in the attempts made by agriculturists to introduce into the northern provinces good, heavy yielding, and relatively early-maturing varieties, such as Ligowo and Guldregn. Good results may be obtained from these varieties in hot years and favoured districts, but in ordinary cold seasons, the setting and ripening of the grain is hindered by the low temperatures, so that the yield of these oats in spite of their specific productivity is lower than that of Mesdag.

Hence it is necessary to obtain for North Sweden a type of oat combining the characters of early maturing and specific productivity in order that the grain may develop and ripen in good time. The combination of these two characters has been the object of much research and of many experiments along the lines of physiological selection and hybridisation

**SELECTION.** — By means of pure line selection, positive results have been obtained with the Meroe oats from which have been derived a new type 0668, which is both early maturing and productive.

Since however the quality of the grain is poor (the seed being small and having a high percentage of glumes), this new product cannot be used directly, but forms excellent material as a base for further crossing experiments.

"Nordsvenska hvithafren" is also not at all homogeneous, but since it is made up of many distinct forms, it could be improved by sorting

From 1900-1906 the author carried out a continuous series of selections, taking as his starting point the large amount of material collected in 1899 by Prof. HJALMAR NILSSON in the province of Dalarna. The final product of this selection was type 0924 (*Svalöf förädlade Dalahafre* = Dala oats selected at Svalöf), which is markedly superior to the population from which it was derived as regards the quality of the grain.

**CROSSING.** — The crossing experiments were begun in 1903. Their

chief object was to combine in a single type the good grain quality and high yield of the best varieties with the early-ripening of the oats indigenous in the North. The experiments began with the series Ligowo  $\times$  0660 (0660 = pure line of *Nordfinsk Svarthaire*) and Ligowo  $\times$  0668 (Meroe pure line). Ligowo is distinguished by the good quality of its grain. In the  $F_2$  (1905), as might be expected, very complicated segregation took place.

Out of 670 individuals of Ligowo  $\times$  0665 a certain, but not very high number have the early-maturing character of the 0668 parent. The seeds of 43 of the plants, that were earliest both in heading and ripening, were sown in the same number of plots. From the best of these plots, a new individual selection of 57 plants was made and their seed sown in 57 plots. Some of the most typical and uniform individuals were harvested together and the seed used *en masse* for the raising of a new strain which gave most promising results during the comparative experiments of 1908-1911. After this date, 32 new lines were selected, one of them being put on the market in 1920 under the name of *Orion* Oats b; this represented the final results of the cross Ligowo  $\times$  06608.

From Ligowo  $\times$  0660 was subsequently obtained by similar methods the *Byrn* Oat which proved superior to *Orion* in the Southern part of Norrland. Lately however it has been surpassed by *Odal* which tends to replace it.

Finally in 1906, the cross Guldregn  $\times$  0924 (selected Dala) was made. Guldregn is distinguished by its high yield, the good quality of its grain and the vigour of its culms. From this cross was obtained by final selection the line 01163, which combines in satisfactory proportions the characters of both parents and was put on the market in 1921 under the name of *Odal* Oats.

From what has already been said, it may be concluded that the pedigree selection of native oats and the crosses made have given positive results in the right direction.

In fact from the cross Ligowo  $\times$  0668 was obtained *Orion*, a type particularly suited to the interior and north of Norrland and to the highest zones. It combines with early ripening good quality and quantity of grain and straw; and its culms are more vigorous than those of 0668.

*Odal* would appear to be the type most adapted to the southern portion of Norrland.

There is no doubt that in these two cases early maturity and productivity have been successfully combined in good proportions with other valuable characters, and it is certain that further improvements can be obtained by continuing to work with uniformity of method along the present lines.

G. A

398 - **Researches on the Question of a Fatuoid Mutation of *Avena Sativa*.** - ÅKERMAN, A., in *Skrifter Utgafeslörenns, Tidskrift*, Year XXXI, Part 6, pp. 266-268. Malmö, 1921.

In the sowings of cultivated oats (*Avena sativa*) individuals are sometimes found that differ in many points from the common type and bear a

certain resemblance to *Avena fatua*. Thus the glumes (including those of the 2nd and 3rd grain), are furnished with a strong curved awn, while at the base, at the height where the ripe grain becomes detached, the calyx is surrounded by a projecting ring of tissue. There is also a tuft of stiff hairs at the base of the seeds.

These aberrant forms, known under the name of *Fatuoiderna* (= Fatuoid), appear not only in the pure lines, but also in the mixed populations.

In addition to these fatuoid forms, other forms evidently of hybrid origin (heterozygotes) are occasionally seen which naturally have a greater resemblance to the normal type.

The progeny of these heterozygotes segregate into *normal*, *heterozygous* and *fatuoid* forms in the ratio 1 : 2 : 1.

The question of the origin of these forms arises. It was at first assumed that they were due to a natural cross between cultivated and wild oats, but this appears not to be the case, for in the first place, *Avena fatua* is not found in the district of Svalöf where NILSSON-EHLE has made a prolonged study of these anomalous forms, and in the second, as has been shown by the results of TSCHERMAK and SURFACE's hybridisation experiments the segregation in the case of true crosses is very complicated, a large number of characters being involved.

In the present case, except for the few points of difference mentioned above, the new and the original form are precisely similar.

If a hybrid origin is excluded, the fatuoid form must be regarded as a true mutant.

G. A.

399 - **Rice Selection in the Philippines.** - See No. 409 of this Review.

400 - **Behaviour of the Hybrids *Medicago sativa* × *M. falcata* from the Standpoint of the Production of Types of Lucerne Suitable for Central Sweden.** - WITTE, H., in *Sveriges Utsädesförenings Tidskrift*, Year XXXI, Part 5, pp. 185-168 Malmö, 1921.

The author first gives a short account of the cultural experiments carried out in different countries with the object of discovering the most valuable types of lucerne. In Sweden, where lucerne is only grown in the Central and Southern provinces, the best results were obtained with Hungarian lucerne and *Medicago variegata* (*M. sativa* × *M. falcata*), and the latter could with advantage be substituted for the Hungarian variety in districts where great vigour and high resistance to cold are specially required.

The author has for some years been making a number of experiments and researches at Svalöf. From the results obtained, he is led to the conclusion that the climatic conditions of Sweden (heavy rainfall and low temperatures), are not favourable to common lucerne from the point of view of seed production. The plant flowers freely but a very small percentage of the blossoms only set seed.

In 1912, the following seed crop was obtained by the author from 13 strong, well-developed plants :

From 1 plant . . . . .	no seeds			
» 8 plants . . . . .	less than	1	gm of seeds	
» 2 plants . . . . .	» »	1.2	» »	»
» 1 plant . . . . .	» »	5.5	» »	»
» 1 plant . . . . .	» »	7.1	» »	»

On average 1.55 gm per plant

With the object of obtaining a vigorous, productive type both as regards forage and seed, the author decided to begin his work with material from *M. sativa* × *M. falcata*. Crosses can be effected easily without emasculation, all that is necessary is to adopt the usual method of applying the pollen by means of a brush to the flowers to be fertilised, after previous isolation.

The  $F_1$  hybrid has characters that are almost intermediate. Its shoots are more branched than those of *M. sativa* and its habit of growth more open, although not so decumbent as that of *M. falcata*. The colour of the flowers, which in the parents is bluish-violet and bright yellow respectively, becomes in the hybrid a dirty yellow, or greenish-yellow with more or less distinct violet-green veining. The pod is intermediate in shape between the sickle of *falcata* and the spiral characteristic of the common lucerne. Stolon development is more vigorous than in *falcata*, but less strong than in *sativa*. A second growth is rare but it is more vigorous than with *M. falcata* when it occurs.

The hybrid is superior in seed production to either of its parents.

In the  $F_2$ , very complicated segregation takes place. As regards stem length, some of the  $F_2$  hybrids have longer stems and some shorter than their parents; the habit of the hybrids is in most cases open as in the  $F_1$ , but some individuals have erect stems as with *sativa* and in other the stems are decumbent as with *falcata*. The colours are the same as in the flowers of the  $F_1$ , other shades such as light-yellow, violet-brown, bluish-violet and white being also found, all associated with the most various and complicated segregation phenomena.

There is not only an intermediate type of habit, but also of pod, as well as types similar to the parental, together with all possible intermediate forms and gradations.

It has been mentioned that the  $F_1$  produces abundance of seed; in the  $F_2$ , seed formation is not common and in certain individuals, completely absent. Some of the  $F_2$  hybrids are however very prolific, as is shown by Table I.

These data show that 378 out of 523  $F_2$  individuals or 72.3 %, produced less than 2 gm. of seed per plant; 111 or 21.2 % produced from 2 to 6 gm., 16 or 3 %, from 6 to 10 gm, 12 from 10 to 20 gm. and one plant only bore 39.8 gm.

In the  $F_2$  it is rare for the plants to shoot a second time but in this respect great variability is shewn.

TABLE I. — *Seed Production in the F<sub>2</sub> of Medicago sativa × M. falcata.*

Seed yield in grammes	Number of Plants					Totals	
	Line 37-1919	Line 38-1919	Line 39-1919	Line 40-1919	Line 41-1919	Plants	%
below 0.01 . . . . .	—	5	9	—	—	14	2.7
0.01-1.99 . . . . .	7	202	118	19	18	364	69.6
2.00-3.99 . . . . .	1	34	39	5	7	86	16.4
4.00-5.99 . . . . .	—	9	11	3	2	25	4.8
6.00-7.99 . . . . .	1	2	4	1	1	9	1.7
8.00-9.99 . . . . .	1	2	3	1	—	7	1.3
10.00-11.99 . . . . .	—	3	2	3	—	8	1.5
12.00-13.99 . . . . .	—	1	1	1	—	3	0.6
14.00-15.99 . . . . .	—	—	2	1	—	3	0.6
16.00-17.99 . . . . .	—	2	—	—	—	2	0.4
18.00-19.99 . . . . .	—	—	1	—	—	1	0.2
38.00-3.99 . . . . .	—	—	1	—	—	1	0.2
Totals . . . . .	10	260	191	34	28	523	100.0

Table II gives the forage yield.

TABLE II. — *Forage Yield of ordinary Lucerne and of the Hybrids of Medicago sativa × M. falcata.*

Kg. of green mass per hectare				
	1st cut	2nd cut	3rd cut	Total
Ordinary lucerne (Hungarian) . . . . .	31 750	22 350	13 250	67 350
<i>sativa falcata</i> (average of 16 Nos) . . . . .	35 000	7 000	1 500	43 500
" " No. 21-1919 . . . . .	43 000	7 500	2 000	52 000
" " " 32-1919 . . . . .	35 000	13 000	500	48 500
" " " 19-1919 . . . . .	19 000	2 000	—	21 000

The first cutting of the hybrid was slightly larger than that of ordinary lucerne, but the second and notably the third cuttings were distinctly smaller.

The author believes that it will be possible by means of continuous and systematic selection, in spite of the complications arising during segregation, to isolate cold-resistant types giving heavy crops of seed and forage, especially for the districts of Central Sweden where the inclemency of the climate precludes all hope of a third cutting. G. A.

401 — On the Origin of a new Line of Red Clover with short Corolla Tube. — LINHARD, E., in *Zeitschrift für Pflanzenzüchtung*, Vol. VIII, No. 2, pp. 95-120. Berlin, September 1921.

In 1907 NIELSEN observed in a clover field in Bohemia several plants with light-coloured flowers and relatively short corolla tubes. Among

the progeny of these plants, were individuals with pale flowers and short corolla tubes, which in 1911 produced two dwarf plants, all the organs being proportionally reduced in size: stems 10 to 15 cm. in height; flowers very small; capitula small and compact; corolla tube 4 to 5 mm. long. It was not possible to obtain seeds and to propagate this dwarf form. The experiments were continued with the family that had produced the dwarf type. In 1911, the author cross-pollinated two late plants with pale flowers and comparatively short tubes (8 mm.). By repeating the operation in the following years, he soon obtained a line with whitish (very pale violet) flowers true to colour, small compact flower-heads and short tubes. This new line was observed to be very accessible to bees, and the author therefore gave it the name of "Bienenklee", the Apitrefle of MARTINET, or bee clover.

The following Table gives in a comparative form the biometric data of the new line and of ordinary red clover.

*The Biometric Data of Bee Clover and common Red Clover.*

	Bee Clover	Common Red Clover	
	1920	No 38.46	No 50.33
Length of tube (in mm) . . . . .	6.91	9.99	(10)
Number » plants . . . . .	36	11	2
» » stems per plant . . . . .	13.3	21.0	31.5
» » flower-heads per plant . . . . .	233	253	314
» » » per stem . . . . .	17.5	12.1	10.0
» » seeds per plant . . . . .	8181	1745	935
» » seeds per inflorescence . . . . .	36	7	3.5
Total weight of plant, in gm. . . . .	145	173	306
» » of each plant, in gm. . . . .	17.6	3.4	2.5
» » of 1000 seeds, in gm. . . . .	2.14	1.90	2.65
» » of seeds in % of total weight. . . . .	11.8	2.0	0.8

This new line is not only distinguished by its relatively short corolla tube, but also by the large amount of seed it bears.

The short tube facilitates the entrance of the bees by which the clover is pollinated.

[G. A.]

402 - Experiments Researches on the Fertilisation of Red Clover (*Trifolium pratense*) in Germany. — SCHLECHT, F., in *Zeitschrift für Pflanzenzuchtun*g, Vol. VIII, Part 2, pp. 121-157. Berlin, September 1921.

This paper gives the results of experiments made at the Phytotechnical Station of Hohenheim, with a view to studying the problem of auto-sterility in red clover. The author in the course of his researches had also occasion to collect important data respecting the moisture of the air, the percentage of seeds that set, the presence of a new disease of the anthers and the occurrence of pods containing two seeds.



**EXPERIMENTAL CONTROL OF AUTOSTERILITY.** — For the purpose of isolation, gauze cages 30 × 30 cm. at the bottom and 80 cm. in height were used.

The operation was effected by exerting a slight lateral pressure upon the standard of the keel, so as to expose the stigma and the anthers. The pollen is collected on a brush and applied to the stigma; before passing from one plant to another, the brush must be dipped in alcohol to prevent any chance of cross-pollination.

The author only obtained a total of 10 seeds from 8589 flowers thus treated which may well have been the result of the involuntary introduction of foreign pollen: the autosterility of clover has thus once more been proved.

In order to confirm the results of the experiment, control tests were carried out on several flower-heads of the same plant, some being artificially cross-fertilised, while others were freely exposed to the visits of insects.

In both cases the percentage of seeds set was very high (from 32.8 to 68.5) thus showing that the operations had been very well carried out. It is clear therefore that the failure to produce seed mentioned above is to be attributed exclusively to autosterility.

When self-pollination (with the pollen of the same plant) is effected through the agency of *Bombus*, some seeds are usually obtained; this fact does not however discredit the theory of the autosterility of the red clover, for it is very difficult to find insects in the country that have not already been in contact with several clover plants.

**THE AGENCY OF INSECTS.** — Can bees act as pollinating agents? It is generally conceded that bees are not able to reach the honey of flowers with too long a corolla-tube. The author carried out 808 biometric determinations and obtained length values ranging from 5.2 mm. to 11 mm. The usual length was 8.9 mm. and the general average 8.7 mm. ZANDER reports that the bee can insert its proboscis to a depth of 7.9 mm.; if this is true, according to the author's statements, 72.5 % of the flowers of the clover would be accessible to bees.

In the control experiments, large gauze cages measuring 85 × 2000 cm. at the bottom and 100 cm. high were used.

The results are summarised in the following Table.

Mode of pollination	No. of inflores- cences	No. of flowers	Fruits set	
			No.	%
Bees . . . . .	125	11 692	6 328	53.2
<i>Bombus</i> . . . . .	100	9 517	4 516	47.5
Flowering in the open . . . . .	100	9 911	4 830	48.7
<i>Totals and averages . . .</i>	<b>325</b>	<b>31 120</b>	<b>15 584</b>	<b>50.1</b>

Thus the bee is as good a pollinating agent as *Bombus*.

EFFECT OF MOISTURE UPON POLLINATION. — Contrary to MARTIN'S conclusions, it would appear that a high degree of atmospheric moisture does not by itself interfere with the process of fertilisation.

TWO-SEEDED PODS. — Sometimes the two ovules produce two ripe seeds.

DISEASE OF THE ANTHERS. — The anthers of the red clover are occasionally attacked and destroyed by a fungus belonging to the genus *Botrytis*, but distinct from the species that are at present known. The author suggests for this fungus the name of *Botrytis antherarum-Trifolii*.  
G. A

403 - Genetic Behaviour of a New Seed Colour in *Trifolium pratense*, in Sweden. — WITTF, H., in *Svensk och Utsädesörensans Tidskrift*, Year XXXI, Part 6, pp 257-265. Malmö, 1921.

The colour of the seeds in clover varies considerably in different individuals, but is always uniform in the same individual. The colour-variations range through all possible shades from light yellow to purplishblack.

The author found in addition to these already well-known colours, another very rare hue, whitish-grey, or white, which had never before been observed.

This particular coloration of the seed always occurs in correlation with white flowers, lack of anthocyanin in the sepals and vegetative parts of the plant; we have therefore to do with an albino form. This character is recessive. In fact, if an albino individual is crossed with a normal, progeny with coloured seeds and white seeds respectively are obtained, in the second generation, in the monohybrid ratio: 3. 1. G. A.

404 - The Histological Characters of the Root of the Sugar Beet from the Point of View of Selection. — FLAHN, H., in *Zeitschrift für Pflanzenzuchtun.*, Vol VIII, Part II, pp 195-205 Berlin, September 1922

Recently, the sugar-beet has been selected less with a view to sugar-content, than with the object of obtaining good root-development, in order to increase the amount of residue which forms an excellent stock-feed.

The present methods of selection, which are based on the polarisation and weight of the root, do not furnish sufficient data to serve as a guide in work directed to obtaining types with high yield and uniting in the best possible proportions both quantity and quality.

The larger size of a root is frequently due to its greater water content, and is not therefore transmissible. In determining the weight of the root it is therefore always necessary to consider the proportion between the water and the dry matter present. The latter alone is of importance from the standpoint of heredity.

In experiments in this type of selection, it would appear that the greatest difficulty is due to the negative correlation between the weight and the sugar content of the root. It is, however, not a question of true

correlation, but rather of co-ordinate dependence due to the fact that most heavy roots contain a large amount of water. This interdependence has been regarded as a basis for generalisation. In reality however types are to be found that combine a high sugar percentage with great weight of root, and the propagation of these types by means of pure lines has done much to show that sometimes the heaviest roots are also the richest in sugar. In selection therefore, as has been said, the dry matter must be taken into account. In the case of two beets of equal absolute weight, the more valuable from the genetic standpoint is the one in which the ratio: *water : dry matter* is lower.

This ratio provides the means of judging whether the tissues of the root are compact or not. The author gives the data for 10 roots. As regards the above ratio, it is possible to distinguish, taking 2.75 as the mean, 6 roots with compact structure (I-III-VI-VIII-IX), with values ranging between 2.71 and 2.61, and 4 roots with loose structure (II-IV-V-X) with values between 2.77 and 2.92. Some excessively large roots (like II-IV-V), weigh a great deal (763-651-560 gm.) but their structure is far from compact (2.92-2.85-2.90); from the genetic standpoint they cannot be regarded as actually heavy.

If a comparison is made between Nos. II and III as regards weight, we find:

Root No. II weighs 763 gm and contains 194.56 gm. of dry matter and 568.43 gm. of water in the ratio of: 1 : 2.92.

Root No. III weighs 684 gm. and contains 188.44 gm. of dry matter and 495.51 gm. of water in the ratio of: 1 : 2.63

Differ: in favour of II: + 79 gm. + 6.12 gm. of dry matter + 72.87 gm. of water in the ratio of: 1 : 11.91

The 79 gm. difference in weight is largely due to a greater amount of water. In order to have equivalence, instead of 6.12 gm. of dry matter and 72.87 gm. of water, 21.75 gm. and 57.25 gm. respectively should have been found.

In estimating the actual value of two beets (again taking as a basis of comparison root No. II), the following equation was obtained:

$$763 \text{ gm (weight of root): } 194.56 \text{ (dry matter) = } 684 : x \\ x = 174.41 \text{ gm. of dry matter.}$$

As a matter of fact, root No. III which weighed 684 gm., contained 188.44 gm. of dry matter, that is to say, 14.03 gm. more.

In the same way, although root No. II with 79 gm. more weight might be considered equal to No. III, it would be necessary, if this were the case, for the weight of 763 gm. instead of being made up of 194.46 gm. of dry matter and 568.43 gm. of water in the proportion of: 1 : 2.92, to be made up of 210.19 gm. of dry matter and 552.81 gm. of water in the proportion of: 1 : 2.63.

Thus beetroot No. II contains 15.63 gm. of dry matter + 15.62 gm. of water and its value is therefore lower than that estimated for beetroot No. III.

If the dry matter content of these roots is calculated in this manner and the average taken as 141.87 the following values are obtained :

No of roots	Actual Value	Proportional Value	Difference
	gm.	gm.	gm.
I . . . . .	214.65	212.00	+ 2.65
II . . . . .	194.56	203.47	— 8.91
III . . . . .	188.44	182.40	+ 6.04
IV . . . . .	168.93	173.60	— 4.67
V . . . . .	145.52	151.47	— 5.95
VI . . . . .	117.54	116.27	+ 1.27
VII . . . . .	102.98	99.47	+ 3.51
VIII . . . . .	102.43	98.93	+ 3.50
IX . . . . .	98.55	94.67	+ 3.88
X . . . . .	85.13	85.60	— 0.47

Therefore the 6 roots with compact structure come in the following order III — IX — VII — VIII — I — VI.

On the other hand if we apply von RÜMKER's correction for the ratio between weight and sugar content and take as a basis of comparison the average weight of a root weighing 532 gm. with 20.72° of polarisation we obtain for root I :

Weight of root I	= 795 gm	
Average weight of all the roots	= 532 gm	Corresponding polarisation = 20.72°
Difference in favour of No. I	= + 263 gm	von RÜMKER's correction = 0.77°
		Corrected polarisation = 19.95°
		Polarisation of root No I = 19.10°
		Difference . . . . . = 0.85

For the more compact beetroots, the following values are obtained.

IX = 1.61; III = 1.25; VI = 0.63; VII = 0.14; VIII = 0.09.

The results of determining the dry matter on the one hand, and the weight of the root and the polarisation angle on the other, do not agree. Therefore, the present methods of selection, which are based on the polarisation and weight of the root, cannot yet be considered as satisfactory.

The polarisation data must be corrected by the sugar content of 100 parts of dry matter, and the structure and absolute weight of the root should also be taken into account .

G. A.

#### SEEDS

405 — **A Bio-Chemical Index for Determining the Vitality of Seeds** (1). — NEMEC, A. and DUCHON, F., in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 9, pp. 631-634. Paris, February 1922.

The authors have shown (*Comptes rendus* Vol. 173, 1921, p. 933), that the activity of the catalyst affords a rapid and easy means of determ-

(1) See *R. March* 1922, No. 253. (Ed)

ining the vitality of seeds. They adopted the following method : 2 gm. of finely ground seeds are mixed with 20 cc. of distilled water and put into a flask with a rubber stopper provided with two holes through one of which passes a funnel with a regulating tap, while an escape tube with two bends passes through the other and thence into a vessel of water and under a gas-bell graduated to tenths of a cubic centimetre. By means of the funnel are introduced 15 cc. of 3 % oxygenated and neutralised water and the amount of oxygen liberated is measured after 5 minutes, and later after 15 minutes.

The results of many experiments have demonstrated that all other factors being equal, the amount of water decreases regularly with the weakening of the germinative capacity.

These results expressed graphically give a regular curve and thus the germinating power of the seeds can be deduced from the amount of oxygen liberated.

In practice, it is well to use the comparative method, and to compare the catalytic activity of the ground seeds under examination with the graphic curve obtained under the same conditions from seeds of known germinative power. P. C.

406 - **The Exportation of Red Clover Seed from Czecho-Slovakia.** — *Bulletin of the Ministry of Agriculture of the Czecho-Slovakian Republic*, Vol. III, No. 1, p. 8. Prague, January 1, 1922.

The seeds of forage crops, especially those of Red, White, Swedish and Crimson Clovers (after which comes the seed of Sainfoin etc.), are among the most important agricultural products exported from Czecho-Slovakia. Statistics show that the following quantities of clover seed were produced in 1920 : in Bohemia, 121 098 quintals ; in Moravia 45 157 quintals ; in Silesia 3 341 quintals, in Slovakia, 34 993 quintals ; in Sub-Carpathian Russia, 2895 quintals ; the total production amounting to 207 484 quintals. Owing to its excellent qualities this seed finds a ready market abroad, especially in England, Scandinavia etc. In 1921, about 300 trucks of red clover seed were exported. There are certain restrictions on its exportation, for as adverse climatic conditions have damaged the clover crops in Czecho-Slovakia, the Government has been compelled to limit the consignments of clover seed sent abroad, in order that the farmers may have sufficient for their own requirements. On the other hand, the Experiment and Seed Testing Stations are protecting the reputation of Czecho-Slovakian clover seed by guaranteeing its purity, power of germination, and freedom from any admixture of weed seeds. G. A. B.

407 - **Steady Decline in Price of Vegetable Seeds in the United States since 1918.** — *Weather, Crops and Markets*, Vol. I, No. 7, p. 129-146. Washington, D. C., Feb. 18, 1922.

Prices quoted for vegetable seeds, both by retail mail-order and wholesale dealers in the United States, are almost uniformly lower than in 1921, and, for most items, the lowest since 1917. The decline has been constant since 1918, when the peak was reached for most kinds. The accompanying table of retail catalogue and wholesale prices show that the prices of beans,

peas, sweet maize, lettuce, and vine-crop seeds fluctuated less violently than did other seeds, including beets, cabbage, celery, spinach, and turnip, of which large quantities normally are imported.

*Average Wholesale (Wh) and Retail Catalogue (R) Prices of Standard Varieties of Vegetable Seeds (\$per pound)*

Kind of seed	1917		1918		1919		1920		1921		1922	
	Wh.	R.	Wh.	R.	Wh.	R.	Wh.	R.	Wh.	R.	Wh.	R.
Beans, dwarf. . .	0.18	0.32	0.26	0.43	0.21	0.41	0.16	0.39	0.15	0.39	0.13	0.37
Beans, garden pole*	0.14	0.26	0.24	0.41	0.23	0.43	0.21	0.40	0.19	0.41	0.15	0.39
Beet, garden. . .	0.90	1.30	1.45	2.35	1.07	1.75	0.64	1.35	0.48	1.15	0.38	1.00
Beet, mangel. . .	0.75	0.55	0.90	1.30	0.68	1.20	0.36	0.90	0.31	0.80	0.27	0.70
Cabbage . . . . .	1.90	3.00	3.80	5.05	8.00	11.10	2.75	5.25	2.40	3.90	2.00	3.15
Carrot. . . . .	1.00	1.40	1.75	2.25	0.90	1.70	0.50	1.30	0.50	1.10	0.40	1.00
Celery, domestic	1.50	2.60	2.25	2.85	1.85	2.90	1.60	3.20	2.00	3.00	1.60	2.75
Celery, imported	10.00	17.00	10.00	15.35	5.00	13.55	4.00	10.45	4.00	9.85	3.00	9.05
Cucumber . . . .	0.54	0.95	0.83	1.75	0.85	1.30	0.86	1.30	1.80	1.40	0.81	1.35
Lettuce . . . . .	0.65	1.35	0.85	1.40	0.90	1.50	0.72	1.55	0.76	1.60	0.76	1.55
Muskmelon. . . .	0.54	1.10	0.78	1.30	0.81	1.35	0.73	1.50	0.79	1.50	0.76	1.50
Watermelon . . .	0.42	0.80	0.70	0.95	0.54	1.15	0.46	1.10	0.45	1.15	0.46	1.05
Onion seed. . . .	1.90	2.50	4.50	5.15	2.65	3.80	1.80	3.15	1.60	3.00	1.20	2.55
Parsley . . . . .	0.35	0.90	0.60	1.05	1.00	1.25	0.60	1.10	0.60	1.10	0.50	1.10
Parsnip . . . . .	0.30	0.70	—	1.75	1.00	1.80	0.40	1.25	0.35	1.05	0.35	1.00
Peas, garden. . .	0.12	0.23	0.19	0.37	0.19	0.38	0.24	0.45	0.19	0.42	0.14	0.37
Radish . . . . .	0.40	0.65	1.60	1.65	1.30	1.65	0.60	1.30	0.50	1.15	0.50	1.10
Spinach . . . . .	0.60	0.90	2.00	2.10	0.75	1.25	0.35	0.80	0.20	0.70	0.20	0.60
Squash, summer .	0.65	0.95	0.80	1.40	1.05	1.50	1.00	1.65	0.90	1.65	0.75	1.50
Squash, winter .	0.55	0.95	1.00	1.50	1.10	1.60	1.10	1.70	1.00	1.60	0.80	1.40
Sweet corn. . . .	0.20	0.26	0.25	0.38	0.17	0.35	0.15	0.36	0.13	0.36	0.10	0.32
Tomato . . . . .	2.75	2.95	3.60	4.10	4.00	4.45	3.25	4.45	3.10	4.25	2.80	3.90
Turnip, English .	0.35	0.70	1.75	1.95	1.35	2.05	0.65	1.40	0.50	1.15	0.35	0.95
Turnip, Swede . .	0.32	0.65	1.50	2.35	1.25	2.05	0.45	1.35	0.37	1.00	0.27	0.90

\* Not including Lima beans.

Any changes in the price of the former group, of which the domestic production is usually sufficient to supply the needs of the United States, may be attributed largely to variations in the cost of production and preparation for market. The supply of the latter group, however, was not controlled by domestic commercial growers and with imports suddenly cut off, the high prices prevailing in 1918 followed. Likewise the rally of domestic growers to supply the deficit thus created, followed by the rapid resumption of imports, caused these items to decline quickly to their 1917 price levels.

On the whole, wholesale prices for 1922 compared with 1921 show a greater reduction than do the retail catalogue prices. The wholesale prices of beans, peas, sweet maize, beet, cabbage, carrot, celery, onion, parsley, squash, and turnip are 15 %-30 % less while the retail-catalogue prices of these items, with the exception of cabbage and English turnip, are only 5 %-15 % less than last year. Very little change, if any, occurred in the

wholesale prices of other kinds of vegetable seeds except tomato which is quoted 10 % less. The average retail prices of tomato declined 8 %, spinach 15 % and watermelon 9 %, cucumber, lettuce, muskmelon, parsley, parsnip, and radish were unchanged to slightly lower.

G A B

408 - Reliability of the Nail Test for predicting the Chemical Composition of Sweet Maize. — APPLEMAN, C O (Maryland Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XXI, No. 11, pp. 817-820, Washington, September 1921.

CEREALS  
AND  
PULSE CROPS

In carrying out the nail test, the thumb-nail is thrust into the kernel, and the exudate examined which is opalescent, milky, creamy and doughy in the 4 successive stages of ripening, at the last stage, the kernels begin to turn yellow.

The author made parallel and comparative experiments with sweet-maize and found from the results of chemical analyses of the kernels that the nail test was reliable, although its reliability is influenced by the rate of ripening and of water loss by evaporation.

He also discovered that

The corresponding stages of crops ripening under different climatic conditions vary both in uniformity of composition and average percentage composition.

The percentage composition of the carbohydrates in the milky stage of a late crop was much more uniform than in the same stage of an early crop.

The nail test is most reliable when applied to crops that ripen slowly in a cool autumn.

In each of the ripening stages except the dough stage, the percentage of total sugar was more constant than the percentage of starch.

As ripening proceeds, the increase in the percentage of starch is much greater than can be accounted for by the decrease in the percentage of sugars. From the beginning of kernel formation until the end of the ripening period there is a continual movement of sugar from the plant into the kernels where it is transformed into starch. The following Table gives the average percentage of the composition of kernels of sweet maize of a late and early crop respectively, as indicated by the nail test. The percentages are calculated with reference to the dry matter content.

*Percentage Composition of Sweet Maize at Different Stages of Ripening*

Crop	Pre Milk Stage		Milk Stage		Early dough Stage		Dough Stage	
	Total sugar	Starch	Total sugar	Starch	Total sugar	Starch	Total sugar	Starch
Early	42.013	22.080	29.183	38.911	13.515	56.519	8.786	59.422
Late	51.200	24.080	35.297	33.475	15.328	50.975	—	—

F. D

409 — **Rice in the Philippines.** — CAMUS, J. S. (Agronomist in Charge of Agronomy Section) in *Government of the Philippine Islands, Department of Agriculture and Natural Resources, Bureau of Agriculture, Bulletin No. 37*, pp. 1-87, tables 10, pl. XLVII. Manila, 1921.

The author gives detailed information as to the climatic conditions, soil and cultural operations associated with rice growing and the cost of production, preparation of grains for the mills and utilisation of by-products, and describes the latest tests and experiments conducted by the various Philippine Experiment Stations especially with reference to varieties, selection, etc.

This bulletin was prepared primarily as a practical guide to the ordinary rice grower of the Philippines, but as it is based on 11 years of experimentation by the Bureau of Agriculture, it is also of fundamental interest to the scientific agriculturist. Certain points of special interest have here been selected.

1) **TYPES OF GRAINS AND VARIETIES** — The commercial varieties of grain measure usually 2.5 mm.  $\times$  5.5 mm., but vary considerably in shape and also in colour. The varieties used for general consumption belong to the non-glutinous group.

Experiments made with a view to the selection of improved varieties of lowland rice (transplanted) have been conducted at the Alabang and Pangasinan Stations, and of upland rice (non-transplanted) at La Carlota and Lamas. Data with reference to habitat, age at heading, maturity and yield for each variety were taken and careful records kept of the best varieties determined.

Most of the lowland varieties tested have shown a comparatively limited range of yields, which will necessitate further trials for some time. Except for timing the planting and harvesting to profit by the average weather conditions, it is not considered advisable to grow a variety that requires more than 150 days to mature. The Apostol (originally known as Señora II) was found to be one of the best varieties and its characteristics may be summarised thus: number of days required from sowing to heading 112, from heading to maturity, 32; yield per hectare 23.83 kg.; shape of grain, somewhat thick, linear oblong, breadth 2.98 mm., hull straw coloured, medium thickness, non-bearded, cuticle white; average length of head at harvest 29.5 cm., average number of grains per head 151; flavour medium.

The 44 most promising varieties out of 282 have already been improved by means of the head-to-row test. Pure strains of these varieties have been isolated, propagated and the seed produced was distributed throughout the Philippines. The varieties tested thus were: Apostol, Cruz, Inasimang, Macan I, Piniling, Daniel, Comer and Roxas. The average yield was 26.48 kg. per hectare; the first four matured earlier than the last three, all of them are non-glutinous and non-bearded.

As regards the Upland varieties out of the 431 tested, the following 11 are recommended for general planting. — Bagonhon II, Binicol I, Catalong, Dinagat I, Inantipolo II, Kinandang Puti II, Kinastila IV, Nagdami, Nagsaya, Pulupot and Saloot. Of these the Kinandang Puti II



matured earliest (106 days). The average yield for these 11 varieties is 22.56 kg. per hectare ; all are non-bearded.

As a result of all the breeding experiments undertaken, it has been shown that by using selected seed the production of rice has been almost doubled.

**SOILS AND MANURES** — In the best rice producing provinces such as Nueva Ecija, Pangasinan, Tarlac, Bulacan etc., most of the soil consists of a heavy clay containing 20 % fine silt and 40 % clay with an adequate supply of humus. This type of soil however has been found advantageous to lowland varieties rather than to upland which require a good loam.

There has been much difference of opinion as to the use of commercial fertilisers, but experiments in the Philippines have shown that a ratio of 5 % nitrogen, 8 % phosphoric acid and 10 % potash is advisable and ammonium sulphate has been found the best form of nitrogenous fertiliser.

**CULTURAL METHODS.** — A description is given of the 5 general methods of planting viz. "cañing" or mountain, dry or upland, "sabog" (palay broadcasted on the rice paddies), and tubigan (lowland).

As regards the methods of seedbedding the, "dry seedbed" method has been proved unsuitable, but the ordinary seedbed method (transplanting 30-40 days from sowing previously sprouted seed) has given good results, and also the so-called "dapog" system of covering with banana leaves by which it is possible to transplant seedlings at a much earlier stage than with the ordinary method. The ordinary system requires on an average 60 to 75 lb. of seed to plant a hectare and the dapog system 15 to 30 lb. more. This latter system is recommended for places where the palay is broadcasted on the paddies or where the planting season is well advanced. It is also advisable in growing early-lowland rice varieties during the regular season.

**CROP ROTATION.** — Although this is not usually practised, the planting of maize or beans especially the mungo (*Phaseolus mungo*) is advised.

**DISEASES AND PESTS.** — Until crop rotation, etc. is practised, the difficulties of controlling the locusts and cutworms (*Prodenia litura* and *Spodoptera mauritia*), rice bugs (*Leptocoris acuta*) etc. are bound to exist.

**COST OF PRODUCTION.** — The following estimates of the cost of production per hectare of the lowland, upland and tenant systems are based on the average cost of labour and actual experiments conducted at certain stations.

From the above estimates and calculating on the average for the 1919 crop of 24.48 cavans per hectare, the cost of producing 1 cavan of palay, taking the average of the 3 methods of planting, will be pesos 2.83 and pesos 5.66 for clean rice. The value of by-products will cover the cost of milling. It is estimated that 100 kg. of palay produce about 62 kg. of clean rice ; 18 kg. of meal or broken grains, 14 kg. of hull and 6 kg. of "bran".

*Estimated cost of production of rice per hectare. 1920.*

Lowland		Pesos
Preparation of seedbed 400 sq metres . . .	1 man and animal daily . . .	1.50
One cavan seed palay . . . . .	daily . . . . .	5.00
Cleaning and fixing dikes . . . . .	. . . . .	0.80
Ploughing 1 hectare of land . . . . .	7 men and 7 animals . . .	10.50
Harrowing with "Sayod" . . . . .	4 " " 4 . . . . .	6.00
Lifting and distributing seedlings . . . . .	2 " " . . . . .	1.60
Transplanting . . . . .	14 women . . . . .	8.40
Care of crop; irrigating, weeding etc. . . . .	5 men . . . . .	4.00
Harvesting with "ling cao" . . . . .	10 " . . . . .	8.00
Stacking and hauling sheaves . . . . .	2 " . . . . .	1.60
Threshing with "piocha" and winnowing . . . . .	5 " . . . . .	4.00
Rental of land . . . . .	. . . . .	20.00
Cost of 32 gunny sacks 0.40 peso each . . . . .	. . . . .	12.80
<i>Total cost . . . . .</i>		<b>84.20</b>
Cost per cavan of palay produced . . . . .		<b>2 63</b>

		Pesos
Seed palay, 35 gantas . . . . .	. . . . .	7.00
First ploughing . . . . .	7 men and 7 animal daily . . .	10.50
Second ploughing . . . . .	5 " " 5 " " . . . . .	7 50
Harrowing . . . . .	2 " " 2 " " . . . . .	3.00
Planting . . . . .	1 man " " " . . . . .	0.80
Weeding . . . . .	8 men " " " . . . . .	6.40
Harvesting with yatab . . . . .	16 women . . . . .	9.60
Threshing and winnowing . . . . .	3 men . . . . .	2.40
Rental of land . . . . .	. . . . .	10.00
Cost of 20 gunny sacks at 0.40 peso each . . . . .	. . . . .	8.00
<i>Total . . . . .</i>		<b>65.20</b>
Cost per cavan of palay produced . . . . .		<b>3.26</b>

		Pesos
10 % depreciation of implements (plough and harrow) . . . . .	. . . . .	3.00
15 % " of 1 carahao ( - zebu) . . . . .	. . . . .	30.00
Harvesting threshing, landlord's share and used animals . . . . .	. . . . .	6.00
<i>Total . . . . .</i>		<b>39.00</b>
Cost per cavan of palay produced . . . . .		<b>2.60</b>

M. L. Y.

- 410 - **Rice-Growing in Messenia, Greece.** — GARDIKIS, J. J. (Departmental Agriculturist of Messenia), in *l'Economiste d'Athènes*, 1st year, No 18, pp 278-279. Athens, January 19-1 February 1922

Rice-growing was introduced into Messenia in 1919 by the Departmental Bureau of Messenia. A preliminary trial was made on 45 *stremmes* (4500 sq. metres). The total crop obtained was 2500 kg of paddy. Next year, 1500 *stremmes* were sown, the yield for 1200 of which was 375 000 kg.

Rice cultivation has attracted the attention of the Government, and the National Assembly passed at its first reading a Bill granting a sum of 100 000 drachmas for the encouragement of the industry.

Messenia rice is superior as a food to the rice imported from abroad. Rice-growing could easily be extended to an area of 13000 *stremmes*, and with careful management of the water-supply which is sufficiently large, this area might be increased to 30 000 *stremmes* and the production might reach 15 000 tons with a value of 48 million *drachmas*.

Great advantages would accrue to the country from rice cultivation, which would be a source of wealth and bring about 350 000 *drachmas* into the Treasury in the form of State taxes. The regulation of the river Pamissos would contribute to the extended cultivation of other crops while the drainage of the Messenian swamps would free the country from malaria.

P. C.

- 411 - **What Amount of Phosphatic Fertiliser is necessary for Rice?** — NOVELLI, N. in *Giornal di Ricoltura*, Vol XII, No 2, pp 20-22 Verelli, February 28, 1922

The author had analysed at the Laboratory of Agricultural Chemistry of the Royal Agricultural College in Milan, a sample of "Chinese originatio" or "Abbondanza", a variety of rice which, together with other very similar types, is the kind most widely cultivated in North Italy. The straw was found to contain 0.40 % of phosphoric acid and the paddy 0.90 %. As the paddy and straw yield per hectare can be reckoned respectively at 60 quintals and 90 quintals, about 90 quintals of phosphoric acid (a substance in which most of the soils of the Italian rice-fields are generally poor), are removed by the crop. The analyses made by the author have shown that few soils contain more than 1 per 1000 of phosphoric acid; the best rice-field soils contain from 0.5 to 1 per 1000. Further the irrigation waters of the principal rice-growing districts of Italy are practically entirely deficient in phosphoric acid, which has therefore to be entirely restored to the soil by the manure.

Leaving a small margin to cover losses, this must be applied at the rate of at least 7 to 8 quintals per hectare of phosphatic fertiliser containing 15 % soluble phosphoric acid,  $\frac{2}{3}$  of which should be harrowed in before the rice-field is flooded, and  $\frac{1}{3}$  after the first weeding, when the rice-field is dried. For the application of the nitrogenous fertilisers, this being a larger amount than is generally used. The author calls attention to the troubles arising from an insufficient quantity of phosphatic fertiliser; late ripening, susceptibility to disease, defective fertilisation and seed-setting.

F. D.

- 412 - Additional Notes on Adlay (*Coix Lacryma-Jobi* var. *mayuen*), in the Philippines (1). — WESTER, P. J., in *The Philippine Agricultural Review*, Vol. XIV, No. 2, pp. 159-177. Manila 1921.

The previous article (1) with reference to the general cultivation and commercial value of the adlay (*Coix Lacryma-jobi* var. *mayuen*) was written before the actual milling and baking tests had been made. The author here reports the information since accumulated.

It has been demonstrated that adlay forms a palatable and wholesome food and according to the data collected it appears that a mixture of equal parts of adlay and wheat flour or  $\frac{2}{3}$  adlay to  $\frac{1}{3}$  wheat, would be equivalent for all practical purposes to an equal quantity of wheat flour, except that it is slightly richer in fat. The nutrient value of adlay in comparison with other cereals and pulse crops is of decided interest: adlay (average of 8 samples tested) 95.4, wheat 87.4, maize 91.2, rice 88.3, oats 80.6.

The great advantage of adlay over rice is that it is possible to grow and harvest with machinery, which is impossible for rice paddies.

With lowered cost of production and an improvement in quality of grain etc, adlay would appear to be destined to supplant rice as the leading staple grain over considerable areas.

The previous rejection of adlay as a staple food may be attributed to peculiar features which have made it inferior to rice as grown by a primitive people, rather than to any intrinsic inferiority in the grain. The advent of modern machinery etc. has removed these objections.

It is interesting to note also that although the long growing season is admittedly a drawback, this is balanced by the fact that adlay is less subject to attacks of locusts than rice and maize and the rice bird and wild pigeon also appear less destructive. This is true also of the rice bug *Lep-tocoris acuta*, one of the two most destructive insect pests of the rice plant.

M, L. Y.

- 413 - Alimentary Value of Some Indo-Chinese Leguminosae. — PRUD'HOMME, R., in *L'Agronomie Coloniale*, Bulletin mensuel de l'Institut National d'Agronomie Coloniale, Year 6, No. 5, pp. 33-41. Paris, February 1922.

The author, after referring to the importance of the importation of dried vegetables from the Colonies to France, describes the various Leguminosae cultivated in Indo-China:

1) PURPLE DOLICHOS (Dâudo) (*Dolichos* var. undetermined) — Its chemical composition is as follows: Water 11.98 %; ash 2.86 %; fatty substances 1.10 %; nitrogenous substances 24.08 %; sacchariferous substances 41.8 %; crude fibre 6.72 %. The natives cook it like ordinary rice; it can be compared to kidney-beans, lentils and common vetches.

2) FRENCH BEAN (Dâu-xanh) (*Phaseolus radiatus*). — This is much the most important of all the Leguminosae. Its chemical composition is as follows: Water 12.10 %; ash 3.12 %; fatty substances 0.64 %; nitrogenous substances 25.40 %; sacchariferous substances 42.86 %;

(1) See R. June 1921 No. 625. (Ed.)

crude fibre 7.84 %. When ground it is used in Annam for making a kind of vermicelli (known by the name of « Songthân »; about 80 000 kg. of which are manufactured and exported to China. This vermicelli differs greatly from that consumed in Europe. It contains a much smaller quantity of nitrogenous and fatty substances but its crude fibre content is higher. Further its composition varies greatly in different samples. The vermicelli contains 25 % less nitrogenous and mineral substances and much more sacchariferous substances than the beans from which it was made.

These beans are much appreciated as a vegetable after germination, and are eaten when the stalks are from 8 to 10 cm in length. They are a common article of diet among the European population of Indo-China. They crop easily if previously soaked in water for about 12 hours (after which they cook in 40-60 minutes). When boiled they much resemble lentils and have a clean pleasant taste. This *Phaseolus* presented on analysis only slight traces of glucosides, it is entirely free from cyanogenetic glucosides, alkaloids, and glucosides poisonous to mice.

3) SPOTTED DOLICHOS (Dâu-truong-quôc) (*Dolichos tonkinensis*); Chemical Composition Water 11.02 %, ash 3 %, fats 1.34 %; nitrogenous substances 23.35 %, sacchariferous substances 38.30 %; crude fibre 8.96 %

VIGNA SINENSIS (Dâu-den-kouta-long) — Chemical composition: Water 12.14 %; ash 3.08 %; fats 1.14 %; nitrogenous matter 24.5 %; sacchariferous matter 43.36 %; crude fibre 7.92 %

WHITE DOLICHOS (Dâu-trang) These three beans can be used in the same manner as the purple Dolichos. All of them need 120 minutes boiling after soaking for 12 hours. They are superior in quality to our ordinary French beans, but not as good as *Ph. radiatus*. Their use is to be commended both as an article of human diet and as a cattle feed.

4) SOY-BEAN — This is a well-known plant and is only mentioned by the author.

To sum up, *Phaseolus radiatus* is the species most suitable for human consumption, though the purple, black and spotted varieties of Dolichos can also be used. The white Dolichos and the soy-bean are chiefly fed to stock.

P. C.

414 — The new Chinese Variety of Lucerne in South Africa. — DONKIN, J. L., in the *Journal of the Department of Agriculture Union of South Africa*, vol. III, No. 3, pp. 257-258 Pretoria, Sept. 1921.

FORAGE CROPS

FAIRCHILD, the "Agricultural Explorer" of the United States Department of Agriculture, found in Thibet, at a height of about 1200 feet above sea level, a new variety of lucerne growing on the edge of a swamp. This variety has been tested for a period of five years at the School of Agriculture of Grootfontein near Middleburg, Cape Province, where for purposes of comparison it has been grown side by side with six other well known types.

Although during the first period of growth this "Chinese" variety as it has been called, could not be considered as equal to the "Provence"

and "Tamworth" types, owing to thin seeding in the two last years of the test it gave hay crops almost equal to those of "Provence" and superior to those of "Tamworth". Observations taken seem to show that "Chinese" lucerne is a hybrid and several variations in stalks and leaves etc. are noted. It is a heavy cropper and particularly resistant to frost.

If grown for seed, 1 oz. is sufficient for a row 100 yards long, which in the second year should produce enough seed for one acre; this should in turn produce a sufficient quantity of seed for sowing broadcast several acres every year.

M. L. Y.

415 - Experimental Trials in Natal with "Hubam Clover" a new Variety of *Melilotus alba* var. *annua*. — HAIL, W S, in *Journal of the Department of Agriculture, Union of South Africa*, Vol III, No 5, pp 463-465. Pretoria, Nov. 1921

The utility of the annual white sweet clover (*Melilotus alba* var. *annua*) as a forage crop and as a legume in short rotations has been the subject of much attention lately in the United States and in Canada.

The Iowa strain of seed, introduced by H. D. HUGHES of Iowa University, has recently been tested at the Cedara School of Agriculture and Experiment Station, Natal (S A), and the variety known as "Hubam clover" has proved a distinct success.

The plant is recommended as a forage crop, but stock should not be allowed to pasture immediately after rain or heavy dew. Although some animals do not appear at first to appreciate its bitter aromatic taste, they soon acquire a liking for it if fed constantly on Hubam clover. Its feeding value compares favourably with other legumes.

In appearance, "Hubam clover" resembles the biennial form of melilotus except that it is somewhat smaller, the root is more woody and crown or resting buds are not formed. The stems, branches, leaves, flowers, pods and seed are indistinguishable from the biennial form.

It has been ascertained by tests made in the United States that the percentage of biennial plants raised from annual seed varies from 1 to 8.

The seed possesses a hard coat and consequently germination is slow unless the seed is scarified and thus enabled to absorb the necessary moisture more readily. Scarified and unscarified seed give a germination percentage of 90 and 30 respectively. A special machine has been invented at the Iowa Agricultural College for this purpose known as the "Ames Hulling and Scarifying Machine".

Soil moisture is necessary; only moderate results are obtained on acid soils, although rather more satisfactory than is the case with lucerne; better results are obtained on alkaline soils.

When the plant reaches a height of 30 in. before the blooming period, it may be cut and cured as hay though it is essential to preserve the leaves carefully. As soon as the plant is wilted, cocks should be made immediately, and left until the stems are cured. It may be ensiled if cut in the early stages before the stems have become woody.

Further tests are being carried out in order to ascertain the agricultural value of this plant in South Africa.

M. L. Y.

- 416 - **Cotton-Growing in Algeria** (1). — FOURNIER (Head of the Experiment Station at Ferme-Blanche, Oran), in *Revue agricole de l'Afrique du Nord*, Year 20, No. 128, pp. 26-29, 2 photographs. Algiers, January 13, 1922.

The author gives an account of the results obtained on the estate of Habra and de la Macta, near Perrégaux. In 1910 the average cotton crop was 13.8 quintals per hectare, which represents about 4.5 of cotton fibre for the varieties Yanovitch and Abassi. The net profit was 745.65 fr. per hectare.

The 1920 results are distinctly higher: the "Yuma" and "Californie" early varieties derived from the Egyptian variety, "Mitafifi", produced over 23 quintals of unginned cotton per hectare. The later-maturing varieties on the neighbouring estates only produced 5.5 quintals per hectare. The land of the Experiment Station had been dressed with 40 quintals of well-rotted dung and 40 quintals of bat guano per hectare.

The pickings succeeded one another without interruption from August 26 to the end of November.

The receipts per hectare were 7068.80 fr. and the expenses 2 525.85 fr. Therefore the net profit was 4 544.95 fr. per hectare, or 6 times larger than in 1910.

At the present time there are 300 hectares under cotton in the Orléansville district.

The varieties selected by Dr. TRABUT, Director of the Botanic Service, Professor of the Agricultural Institute of Algeria, produce bolls that can be gathered before the heavy rains set in. Their yield is satisfactory, and they are much earlier than "Yuma," or "Californie". The author adds that the cotton-plant can bear relatively large quantities of salt. P. C.

- 417 - **Irrigation Schemes in the Niger Territory of the French Soudan and the Extension and Improvement of Cotton Production.** — I. LELUC, J., *Le coton du Soudan et les grands projets d'irrigation in L'Avenir Textile*, No. 9, pp. 9-11 Guebwiller (Haut-Rhin), July 1921. — II. HÉLO (Secrétaire général du Comité du Niger), *Les irrigations du Niger et la culture cotonnière au Soudan, in Renseignements Coloniaux et Documents publiés par le Comité de l'Afrique française et le Comité du Maroc*, pp. 127-220 Paris, Oct. 1921.

I. II. — Up to the present time cotton has been cultivated in the French Soudan over an area of more than 150 000 sq. km., but the irregularity and short duration of the local rains has resulted in inferior quality fibre and poor yield. With the object therefore of introducing and developing varieties with medium and long fibres and extending the cultivated area, schemes have been put forward to systematise and establish regular irrigation and the utilisation of the floods of the river Niger which occur at a time of year propitious to cotton development. For example, during 200 days (June to January), the Niger distributed more than 400 cub. m. per second, and it is estimated that this would serve to irrigate a cotton area covering from 400 000 to 500 000 hectares *i. e.* 1 200 000 to 1 300 000 hectares on a triennial rotation system.

(1) See *R. Mar.* 1917, No. 243; Aug. 1918, No. 865; Oct.-Dec 1919, No. 1138. (Ed.)

According to the remarkable Scheme prepared by the hydraulic expert BÉLIMF, it will be possible to obtain as a result of methodically established irrigation, first quality cotton ranking with the best known varieties, Sakellaridis etc., as well as remunerative yields. It is a recognised fact that Cambodia, Algeria and Senegal etc. yield a considerable quantity of cotton, but it is now considered evident that the most valuable area will be in the Niger valley.

The authors give an outline of the programme of proposed irrigation work, the lines of canals etc

M L Y.

418 - **Cotton Growing in Queensland.** — BOYD A. G., in *Queensland Agricultural Journal*, Vol. XVII, Pt. 1, pp. 32-34. Brisbane, Jan. 1922.

Distinct advances have been made quite recently in connection with the extension of the cotton areas in Queensland. Very favourable reports as to the future possibilities of this country, have been presented by VAUGHAN (Ex-Premier of South Australia) who states that the British Government has set aside a sum of £1,000,000 for the encouragement of cotton-growing within the Empire, a portion of which would be devoted to the establishment of the industry in Queensland. Up-to-date machinery (cotton gins etc.) has been imported for use with the next crop, which is expected to be a comparatively heavy one.

A short time ago VAUGHAN secured cotton samples from different districts and submitted them to English cotton brokers for inspection. Opinion was unanimous that the samples possessed all the best qualities of the more valuable cottons of other countries (probably including America, Egypt, Africa and India), in respect of length, strength of fibre, colour, etc.

Up to the present, practically all the inland areas have been cultivated with the Uplands variety (short staple), and the Sea Island type has been limited to coastal areas. It is proposed however to use Sea Island to a much larger extent inland next year, as the long-staple is of great commercial value.

An important point in favour of Queensland as a cotton producer is that the plant is almost entirely free from the diseases which cause so much damage in the cotton districts of the United States and Egypt.

M L Y.

419 - **New Fibre Crops in the Belgian Congo, and their Industrial Value.** — GOOSSENS, (Directeur du jardin botanique d'Étala), in *Bulletin Agricole du Congo Belge*, Vol. XII, No. 3, pp. 622-623. Brussels, Sept. 1921.

The Jardin botanique d'Étala has recently carried out a series of observations under the direction of CORNUSIER with a view to ascertaining respectively the values of various fibre plants, both native and imported.

The annexed Table shows the results of the investigation. It is stated that although the imported varieties do not appear to adapt themselves readily to equatorial conditions, excellent results have been obtained in the Lower Congo (Ganda-Suudi and Congo da Lemba).



*Results of the Cultivation of Textile Plants in the Belgian Congo.*

	Name of plant	Weight of stems	Period of retting	Weight of fibre	No of days of work	Time required to produce 1 kg. fibre	Net cost 1 kg. fibre	Yield
		kg	days	kg.	days	days	fra.	%
Native	<i>Urena lobata</i> var. <i>reticulata</i> (Kuluende) . . . . .	615.3	15	49.88	57.00	1.15	0.86	7.95
	<i>Urena lobata</i> (Lotiti muindu) . . . . .	638.4	20	36.00	58.87	1.68	1.26	5.64
	<i>Triumfetta cordifolia</i> (Bekongue) . . . . .	1517.5	15	70.235	70.8	1	0.75	4.61
	<i>Cephalonema polyanthum</i> (N'dolo n'kongue) . . . . .	1580.0	20	76	83.7	1.10	0.82	4.81
	<i>Honckenia ficifolia</i> (Bonkongue n'inga) . . . . .	666.5	22	33.280	111.3	3.34	2.50	5.00
	<i>Mannisphyton africanum</i> (N'kossa) . . . . .	785.0	—	25	134	5.36	4.02	3.18
Imported	<i>Agave rigida</i> var. <i>sisalana</i> . . . . .	300.0	—	11	65	5.90	4.42	3.66
	<i>Furcraea gigantea</i> . . . . .	880.0	—	14	120	8.57	6.42	1.50
	<i>Sanscra guineensis</i> . . . . .	14.0	—	0.190	—	—	—	1.35
	<i>Sanscra cylindrica</i> . . . . .	14.0	—	0.150	—	—	—	1.07

The stems of *Mannisphyton africanum* are not retted, but they are scraped immediately after cutting, and exposed to the sun, and after a few days, the fibre is extracted by thrashing.

It has been noted that the period of retting is regulated according to the stage of maturity of the stem, the type of soil also plays an important part in this process.

Although the actual quality of the fibre is not of equal value to that of the imported species, attention is drawn to the fact that certain native species, especially *Urena lobata*, can be utilised advantageously as a source of fibre at a comparatively low cost.

M. L. Y.

120 - **The Possibilities of Developing the Roselle (*Hibiscus Sabdariffa* var. *altissima*) Fibre Industry in the Federated Malay States.** — SUTTH, T. W., in *The Agricultural Bulletin of the Federated Malay States*, Vol. IX, No. 1, pp. 23-26. Kuala Lumpur, Jan-Mar 1921.

As a result of the small scale experiments carried out by MATHIEU at Kuala Kangsar, with *Hibiscus Sabdariffa* var. *altissima*, the following conclusions may be drawn:

This plant appears to adapt itself readily to prevailing conditions in the Federated Malay States.

The lateral branches when cut at the right age (i.e. when the plants are just beginning to flower and when if properly developed, the branches should be over 4 ft. long), should give a good quality long staple fibre, suitable for spinning. Reports from the Imperial Institute, London

confirm this statement. On the other hand if the branches are cut when too old, the fibre is found to be matted and consequently of inferior quality.

Fibre from the *main* stem is however of inferior colour, appearance and quality and the staple is shorter and is in fact of no value commercially.

The plants seed fairly freely but are liable to attack by the cotton stainer *Dysdercus* spp.

Further experiments are in progress to determine the best planting distances to adopt, and also to obtain a large supply of seed of both the red and the green varieties. Seed is being distributed to various plantations for test purposes.

The work in general is as yet at an early stage and investigations are still necessary with reference to cost of production, methods of cultivation etc.

M. I. Y.

**RUBBER, GUM  
AND  
RESIN PLANTS**

421 - The Quality of the Rubber of *Hevea brasiliensis*: its Variations and their Causes. Economic Importance for the Amazon Rubber Industry. — CAYLA V (Professor of General Agriculture) in *Archivos da Escola Superior de Agricultura e Medicina Veterinária*, Vol V, Nos 1 and 2, pp 71-96 Niteroy (E. do Rio), Sept. 1921

A factor frequently introduced into the very complex question of rubber production, which is of paramount importance to Brazil, is the quality of the product, that is to say its market as apart from its intrinsic quality.

For manufacturers or producers, there is nothing absolute in the quality of rubber which can however be determined scientifically from its physical and chemical constants, as has been shown by the valuable, exhaustive and accurate laboratory experiments systematically made by the Dutch since 1910.

Hitherto the commercial determination as carried out, for instance, by the brokers has been accepted. This determination was based on external characters: form, appearance of surface, colour, smell, appearance of a single section, elasticity determined roughly by pulling a sample between the hands etc. These observations can only furnish very incomplete information, and are useful only to expose 1) the grossest frauds, 2) the state of the preservation of the rubber, 3) its geographical origin.

The quality of rubber can be approximately determined by: 1) the quantity of coarse, visible impurities (decrease in useful weight); 2) the presence or absence of diseases: moulds, and especially stickage, which causes bad vulcanisation, 3) the knowledge acquired by long experience of the various kinds of crude rubber according to their origin, botanical source, processes of coagulation, drying etc.

In scientific determination, the Dutch systematic researches take into account: 1) the chemical analysis of the crude rubber (the water, resin, ash and nitrogenous substances present together with the acidity); 2) the physical constants: viscosity of the rubber solutions; vulcanisation coefficient; mechanical test of vulcanised rubber; tension test; degree of elasticity; of elongation (permanent deformation etc.).

In the present condition of knowledge on the question, it remains necessary to accept the definition of the producers and dealers; rubber of good

quality is clean, sufficiently dry, sound, well preserved and not very variable. The dealer indeed only reflects the wishes of the manufacturer, and the latter prefers the rubber that suits him best and will pay a higher price for it. He requires that the rubber shall be :

1) Clean and sufficiently dry to reduce loss in washing, which, when considerable, increases the loss in weight of the raw material, necessitates more labour and makes greater demands on the apparatus and the fuel driving the machines ;

2) Sound, because sticky (*i. e.* resinous) rubber contaminates the pure product, vulcanises badly and also entails loss ;

3) In a good state of preservation, for any deterioration means a loss of useful material, and owing to the mode of preparation of crude rubber, it is more or less liable to spoil.

4) As little variable as possible ; this is necessary, because all the treatments to which rubber is subjected in the factory are empiric, and with an invariable rubber the formulae need not be altered.

It is necessary also to mention the preference given by manufacturers to certain rubbers for reasons unknown to dealers or producers, which they are unable to detect.

The author deals with the grounds of this preference in the case of *Hevea brasiliensis* rubber in Brazil, and in the plantations of the Middle-East. Since competition has arisen in the markets of the world, the manufacturer is always willing to pay a higher price for "Para hard core" than for "white crepe first latex" (which are the two best qualities), without taking into consideration the fact that "Para" loses 18 to 20 % in washing and "Plantation" 2 % at the most.

The author is, however, of opinion that this difference in the prices quoted which has prevailed for twenty years, though no doubt it has now decreased, has sufficed to insure that Para rubber is still really superior in quality to "Plantation".

This difference in quality has been attributed to three causes : 1) the origin of the trees ; 2) the age of the trees ; 3) the preparation process to which the raw rubber is subjected. The author draws the following conclusions from his examination of the question.

1) The origin of the trees cannot account for the difference in the American and Asiatic products ;

2) the effect of age upon trees ready for tapping is very slight and quite insufficient to explain the difference observed ;

3) although it is impossible to adduce actual proof, it would appear that the principal cause of the difference in the quality of "Para fina" and "first latex" undoubtedly lies in the method of preparation.

After discussing the alleged defects of the commercial varieties of both "Para" and "Plantation" rubbers, the author expresses his belief that both could be improved. For Brazil the practical lesson to be drawn from this fact is that with sufficient care, "Plantation rubber" could be made as acceptable to the manufacturer as "Para fina".

The author believes that the improvement of Brazilian rubber is to be sought in the reduction of the net cost for : a) eastern competitors can improve their rubber until it is practically equal in quality to "borracha" ; b) since Brazil no longer controls the market, she cannot fix the price of rubber merely by supplying rubber of better quality ; c) only taking into account the exceptional quality of the product would mean reducing the amount exported to a very insufficient quantity. This does not mean that the quality of the rubber should be sacrificed. On the contrary it is necessary : 1) to keep the manufacturing quality equal or superior to that of the eastern rubbers ; 2) to improve the commercial quality by more careful preparation and the suppression of adulteration.

In fact the reduction of the water and of the impurities to 2 % in weight is equivalent to reducing the cost price, since with "borracha" in leaves coagulated by "defumação", it is possible to obtain on the European markets a plus-value of 14 % as compared with the price of the balls. The leaf form has the following advantages over the balls : 1) with equal weight, a plus cash value of 14 % ; 2) freight paid for 2 % of impurities instead of for 20 % ; 3) export dues paid on 2 % of impurities instead of on 20 %.

In short, the author is of opinion, that the difference in the quality of the two *Hevea* rubbers, the Brazilian and the Indo-Malayan, is almost entirely due to differences of preparation ; that it is decreasing, and may disappear altogether. He also believes that, since the manufacturers recognise that the quality of the best Amazonian product is equal or superior to that of "crepe first latex", it is only necessary to maintain this quality. Further that for economic reasons, it would be advisable to improve the commercial quality of "Para fina", as its quality must not be relied upon as the sole means of solving the "borracha" crisis.

G. A. B.

422 - Investigations made in Java Concerning the Origin of the Latex of *Hevea brasiliensis*. — BOBILIOFF, W., in *Archief voor de Rubbercultuur in Nederlandsch-Indië*, Year. 5, No. 3, pp. 95-111, figs. 5. Buitenzorg, March 1921.

Different methods of tapping *Hevea brasiliensis* were carried out with a view to making direct observations as to the exact origin of the latex and to ascertain the direction of the flow and the effect of grafting a species having a yellow latex on another having a white latex.

The results obtained from this investigation may be summarised as follows :—

1) The change of colour of the latex from yellow to white in the neighbourhood of the tapping cut which gives a yellow latex, makes it possible to control the extraction sphere of latex when tapped. The appearance of white-coloured latex at places where previously the yellow colour was present indicates that these places are exhausted and that secondary latex-building is taking place.

2) The flow of latex to the tapping-cut is very slow and about 2½ months is required to cover a distance of about 1 metre.

3) The extraction by ordinary tapping from above downwards occurs only from the latex vessels which lie underneath the cut and about 1 cm. on each side of the cortex.

4) The extraction of latex by tapping from below upwards is slightly less than by the reverse method.

5) If the cut is high above the ground, the latex is extracted also from the roots, but only from the places lying below the cut or in the vicinity. In this case the latex is extracted from the side roots, but only from those under the tapping cut.

6) Above the tapping cut there is no extraction of latex by ordinary tapping.

7) Three year old grafted trees from a common parent with yellow latex grafted on stock with white latex continued to give the yellow latex and the new stock white latex.

M. L. Y.

423 - **Sugar Beet Cultivation in Louisiana, United States.** — COATES, F. C., and KIDDER, A. F. (Louisiana State University, Baton-Rouge, Louisiana) in *The Journal of Industrial and Engineering Chemistry*, Vol. XIV, No. 3, pp. 213-214, Washington, March 1, 1922 (1).

SUGAR CROPS

A long series of experiments have proved that it is possible to grow sugar beets, of high sucrose content and purity combined with great productivity, in Louisiana and presumably also in the other southern States of the Confederation. The best results are obtained by late spring planting. The yields averaged 18 tons per acre, the weight of the beets was 1.5 to 2.5 lb., the purity about 85 % and the sucrose 14 %. In order to obtain such results it is, however, necessary to use good seed which breeds true to type. Seed grown in the United States to-day fulfils this requirement and appears to be even better than European seed.

The first experiments in sugar-beet growing were made by one of the authors in 1898, at the Louisiana State University, with seed imported from Europe and sown in November; afterwards sowings were made in August, and mature roots obtained in February. Under these conditions beetroots can be matured in May, June and July, and probably also during March and April. The tonnage per acre in Louisiana is probably heavier than elsewhere, and the sucrose and purity are high enough for commercial purposes, while the cost of cultivation is much less than in most beet-growing sections, being from 15 to 20 dollars per acre.

A series of analyses shows that beets after harvesting will keep for a week or more without appreciable loss in sucrose or purity. These results are probably too favourable, but it is reasonably certain that, after harvesting, beets in Louisiana will not deteriorate more in May, June and July than sugar-cane in Cuba during the same months.

Beets planted on January 24 are ready for harvest by May 8 and probably earlier; they can, however, be lifted in good condition until July and even later. If beets could be matured early, they could be worked

(1) It should be noted that in the district in question, the sugar-cane is grown to its climatic limit. (Ed)

into sugar in Louisiana and thus extend the sugar season for 3 months or longer. This would double the value of the sugar factories which normally can only run for about 2 months in the year. G. A. B.

424 - **Wild Beets: Composition and Value.** — See No 391 of this *Review*.

STIMULANT,  
AROMATIC,  
NARCOTIC AND  
MEDICINAL  
PLANTS

425 - **The Possibility of Growing Tea in Italy.** — CAVARA, F, in *Bollettino dell'Associazione italiana Pro piante medicinali, aromatiche ed altre utili*, Year IV, Nos 7 and 9, pp. 106-109 and 133-138. Milan, 1921

Long experience has already proved that the tea-plant can grow in certain parts of Italy, it has been successfully cultivated in the Botanical Gardens of Pavia (by putting it under cover during the winter), Florence, Pisa and Naples, and also in the Borromean Islands on Lake Maggiore etc.

According to the opinion both of the author and CARNEL, there exist in South Italy, Sardinia, and Sicily very sheltered shady valleys where tea could be cultivated. BECCARI was of opinion that the tea plant would thrive in Italy in the olive zone, where it could, if necessary, be grown beneath the olive-trees or vines, and thus obtain a little shade. It has been proved, however, that the dry maritime climate of the Mediterranean does not suit tea and that this is the reason of the failure of several experiments in growing the plant in Sicily.

Twenty years ago the author distributed as an experiment some young tea plants to several landowners from Tuscany to Calabria. As it was a question of a new crop with special requirements as to temperature and atmospheric and soil moisture (the tea-plant cannot stand lime), it is not surprising that most of the trials failed. In one case however on an estate in the commune of Bagni di San Giuliano (Prov. of Pisa), all the plants struck root and grew, producing after some years both flowers and fruits, and very fragrant beverage was made from the leaves. The author strongly recommends the renewal of these experiments. They could also be made in some suitable parts of Eritrea and Somaliland. F. D.

426 - **Manuring Coffee.** — I Manures for Coffee Plantations, in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No 9, pp 317-319, bibliography, London, 1921 — II, Coffee in Guatemala and Costa-Rica, *Ibidem*, pp 316-347 — III HERMANN, J. A., Cafeicultura e os adubos, in *Annaes da Sociedade Rural Brasileira*, No 17, pp 1043-1050 São Paulo, November 1921 (1)

The effects of the application of chemical manures to Coffee plants have not been studied for a sufficiently long period to justify their recommendation for general use.

Such active artificial manures as sulphate of ammonia, sulphate of potash, nitrate of soda, superphosphate etc., are undoubtedly of value for annual crops where immediate results are desirable and the temporary character of the fertiliser is of secondary consideration, but for coffee or any other perennial plant where a slower and more lasting effect is required a similar value has not been established. In fact Sir John LAWES has

(1) See *R* Jan 1915, No 18 (Ed)

stated that "most decidedly the active artificial manures would not be suitable for the coffee-tree", but considerable difference of opinion on the point seems to prevail in all coffee-growing countries.

The manures, however, that can be safely recommended are those of an organic character, including prunings, leaves, weeds, coffee pulp and other refuse obtained in the preparation of the coffee-bean, farm-yard manure, green-manures, bone, dried blood, oil-seed cake, guano and fish manure, to which may be added the organic substances, wood-ashes and lime. The use of farm manures and green manures may not be practical on all plantations, but the suggestion of rotting down straw to take their place deserves consideration. As wet straw alone will not rot down, and some active form of nitrogen is required to start the process, this may be supplied by the urine from stock, or by passing sewage through a filter-bed made of straw (1).

The selection, however, of any of the manures mentioned can only be decided as a result of knowledge of local conditions and after experiment, for it must be based on convenience and cost.

A manure of considerable value may be made by mixing coffee-pulp with bone-meal (in the proportion of about 1 part of bone-meal and 20 parts of coffee-pulp), together with any general refuse from the plantation, heaped or buried for several months in a place where there is protection from sun and rain. When sufficiently decomposed the manure may be dug in round the trees, without injury to the roots if possible, or laid on as a mulch. The pulp together with the parchment and other refuse from the factory is valuable on account of the nitrogen, phosphoric acid, potash and lime it contains, while the bone-meal is useful as supplying phosphoric acid, lime and nitrogen. The percentages in the coffee-pulp of these constituents are considerably higher in material when fresh than after exposure for several months to sun and rain, and it is important to preserve it as above described. Any wood-ashes that may be available from burning rubbish on the plantation can be put into the manure heap to increase the supply of potash. As tropical soils are often deficient in lime, slaked lime can when necessary be distributed over the whole plantation before applying the mixed or other manures, at the rate of about 15 cwt. per acre, or with trees 3 ft × 3 ft, this would be approximately 3 lb. per tree.

TABLE I. — *The annual requirements for 1000 Coffee Plants (at different ages) of nitrogen, potash, and phosphoric acid.*

Age of tree	Nitrogen	Potash	Phosphoric acid
	lb.	lb.	lb.
First 4 years . . . . .	9.87	23.62	2.49
From 5 to 8 years . . . . .	35.7	76.92	19.57
From 9 to 20 years . . . . .	28.87	45.83	15.76
After 20 years (old trees) . . . . .	5.09	30.53	9.48

(1) See R. March 1922, No. 236. (Ed.)

II. — As regards the manuring of coffee-trees in Guatemala and Costa Rica, it is stated that coffee has been grown in these countries for nearly a century upon soil characterised by its high humus content, for the plantations occupy the site of original forests and much leaf-mould is produced by the plants and the shade trees. There is, however, a clear need of manure, for the soil is usually deep and sometimes stony. Lime and natural manures are recommended in preference to artificial manures.

III. — The author of the 3rd publication states that a large number of the old coffee plantations in the State of São Paulo of Brazil show signs of degeneration owing to neglect for several decades and especially to insufficient supplies of humus and lack of regular manuring. The author estimates that a crop of 750 kg. net of coffee has been obtained per 1000 trees during the last 10 years from the 800 million trees in bearing. The amount of nutritive substances removed from the soil is given in Table II. In order to replace these elements, it would be necessary to apply the natural or artificial manures given in Table III, but these quantities would have to be doubled or trebled in order to restore the plantations to their original condition.

TABLE II. — *Exportation of coffee from the State of São Paulo from 1850-1919 with the amount % of fertilisers extracted annually.*

Coffee Exports		Fertilisers extracted annually					
in the 10 year periods	Annual average in thousands of bags	Nitrogen	Total ash	in the ash			
		1.75 %	2.84 %	Phosphoric acid 12.53 %	Potash 68.25 %	Lime 6.15 %	Magnesium 11.11 %
		tons	tons	tons	tons	tons	tons
1850-59. . . . .	2 500	2 625.0	4 260.0	578.9	2 779.7	260.7	468.6
1860-69. . . . .	2 835	2 976.8	4 830.8	605.3	3 152.1	295.7	531.3
1870-79. . . . .	3 675	3 858.8	6 262.2	784.7	4 086.1	383.3	686.9
1880-89. . . . .	5 473	5 746.7	9 326.0	1 168.6	6 085.2	570.8	1 025.9
1890-99. . . . .	7 226	7 587.3	12 313.1	1 542.8	8 034.3	753.6	1 354.2
1900-09. . . . .	9 027	9 374.2	15 375.2	1 926.5	10 032.3	941.0	1 691.3
1910-19. . . . .	9 821	10 312.1	16 735.0	2 101.7	10 921.0	1 021.4	1 837.5
Average per bag . . . . . kg.		1.050	1.704	0.214	1.114	0.104	0.187

In order to find out whether it would pay to improve old coffee plantations the author carried out experiments, in 1913, on a 60 to 70 year old plantation belonging to the " Instituto Agronomico do Estado de São Paulo (Campinas) on 6 series of plots: A) control plots, without manure, but ploughed and pruned; B) 28 kg. of farmyard manure per tree; treated otherwise like A; C) 17 kg. fresh coffee pulp per tree; treated otherwise like A; D) 0.56 kg. superphosphate + 0.2 kg. potassium chloride + 0.2 kg. ammonium sulphate per tree; treatment otherwise as for A; E) 7 kg. farmyard manure + 0.15 kg. basic slag + 0.075 sulphate of potash +



0.065 kg. of nitrate of soda per tree, treatment otherwise as for A. The manures were applied 3 times, viz., in 1913-1914, in 1914-1915 and in 1916-1917. Table IV gives the results obtained after 8 years of experiment-

TABLE III. — *Quantities of Manures necessary to replace the substances removed from the soil.*

Ten year Periods	Farmyard manure annual average	Chemical fertilisers		
		Chloride of potassium containing 50 % potash	Nitrate of sodium containing 16 % nitrogen	Basic slag containing 16 % phosphoric acid soluble in citric acid
	tons	tons	tons	tons
1850-59 . . . . .	550 930.0	5 559.3	16 406.3	3 559.2
1860-69 . . . . .	630 426.6	6 304.3	18 604.6	4 035.2
1870-79 . . . . .	817 217.0	8 172.2	24 117.2	5 231.0
1880-89 . . . . .	1 217 042.0	12 070.4	35 916.6	7 790.3
1890-99 . . . . .	1 606 859.4	16 068.6	47 420.6	10 285.5
1900-09 . . . . .	2 006 859.4	20 064.6	59 213.4	12 843.4
1910-19 . . . . .	2 184 190.4	21 842.0	64 450.6	14 011.3

TABLE IV. — *Yield of cleaned coffee per thousand plants.*

	Before the 1913 trials	Average for the 8 years 1914-21	
		Yield	Excess due to manuring
Plot A . . . . .	184 litres	585 litres	— litres
" B . . . . .	202 "	1229 "	644 "
" C . . . . .	80 "	1228 "	642 "
" D . . . . .	130 "	1452 "	914 "
" E . . . . .	155 "	922 "	338 "

From these results the cultivation expenses for 1000 plants can be calculated.

TABLE V. — *Cultivation experiments for 1000 trees (in francs at par).*

	Total receipts 1914-1921	Total cost 1914-1921	Gross returns		Value of trees, cost of improvements and material	Average annual interest
			1914-1921	annual average		
Plot A . .	10 601.87	7 765.34	2 836.53	354.75	4 106.40	8.63 %
" B . .	24 860.99	11 239.07	13 621.92	1 702.74		41.46
" C . .	27 511.49	13 419.71	13 991.78	1 748.97		42.59
" D . .	28 371.26	10 474.43	17 896.83	2 237.00		54.48
" E . .	19 150.55	9 896.71	9 253.84	1 156.87		28.17

It is also interesting to know the condition of the different plots. This is shown by Table VI.

TABLE VI. — *Number of productive trees per 1000.*

	Before the application of the manures — 1913	8 years average — 1914-1921	In the last year — 1921
Plot A . . . . .	825	748	670
„ B . . . . .	480	845	770
„ C . . . . .	110	946	930
„ D . . . . .	240	713	590
„ E . . . . .	620	914	900

The author estimates that the minimum return a good cultivator should obtain from a coffee plantation is 28.17 %, the amount produced by the plots of series E. G. A. B.

427 — **The Cocoa Industry of Ecuador and Possibilities of Introducing certain Varieties into Other Countries.** — TUDHOPE W. E. D. (Director of Agriculture, Gold Coast) in *Bulletin of the Imperial Institute* Vol. XIX No. 3, pp. 318-360. London, 1921

Report of investigations made chiefly in connection with the "Arriba" cocoa which constitutes over 50 % of the total export of cocoa from Ecuador.

The variety grown is almost exclusively that known as "Cacao Nacional" which possesses large pods weighing as much as 3 ¼ lb. and containing a large quantity of well formed beans; the seed contents of a number of pods examined, ranged from 40 to 51 (average per pod 44). This is evidently a superior type and produces on an average, 1 lb. of cocoa per 7 pods.

In the "Arriba" Province some fruits ripen every month of the year, though there are only 3 recognised crop seasons viz. February to June, July to October, and November to January.

During recent years Venezuelan varieties have been planted to a certain extent, as they have the reputation of giving a heavier yield and of maturing earlier than the former type, but apparently the Monilia disease has proved more virulent with these newly tested varieties, and apart from the fact that the trees do not grow so tall and big as the Cacao Nacional and therefore overcrowding is avoided, the superiority question is still open.

Practically all the cocoa exported is merely dried in the sun, a process which under ordinary conditions only requires 7 days.

The author considers that if the beans are given only a slight fermentation in mass before drying, more satisfactory results might be expected. Apparently in Ecuador only a very light fermentation is necessary to produce the desirable "chocolate break" in the dried bean. It may be con-

cluded that the beans are of superior quality to those for example of the Gold Coast, where it is reported that 6 days fermentation in boxes is necessary before even sun-drying is employed, in order to produce a similar chocolate break in the bean. The cocoa bean with the lightest coloured testa possible has the highest commercial value but it does not follow that this is "unfermented cocoa" in the Ecuador types. If drying is unduly prolonged by dull weather, a condition similar to over-fermentation is brought about resulting in discoloration of the testa in the form of little brown or black spots, a condition often present if the pods are over ripe before they are gathered, or if they are left in heaps some time before drying, despite suitable weather conditions for sun-drying.

On an average twenty labourers with 15 mules are regarded as sufficient for the maintenance of a plantation of 100 000 bearing trees. A labourer is paid about 1 *sucre* (= 2s 6d) per diem.

For valuation purposes the value of a plantation has been estimated by local banks at an average of about 80 *centavos* (2s) per tree in bearing.

The price of cocoa in 1920 was 42.50 *sucre*s per quintal in Guayaquil but there is obviously a wide margin for fluctuation which serves to indicate the profitable nature of the industry. The total costs to port of shipment are reported as about 8 *sucre*s per quintal (20s per 100 lb); the cocoa is shipped in bags containing 175 lb. net.

The "Asociación de Agricultores del Ecuador" which comprises all the producers and possibly also all the exporters of cocoa has for its main object the defence of the industry against the speculations of foreigners which tend unduly to lower the price of the local product, and is empowered to collect an export tax, in addition to the official Government export taxes.

This investigation was made with a view to the possibility of introducing the "Nacional" variety into the Gold Coast, Ceylon and other countries, and comparisons are made between the systems adopted on the Gold Coast and those employed in Ecuador.

M. L. V.

428 - **Factors other than those of Environment influencing the Alkaloid Content and the Yield of Latex from the Opium Poppy in India.** — ANNETT, H. E. (Agricultural Chemist to the Government of Bengal), SEN H. D., and SINGH H. D., in *Memoirs of the Department of Agriculture in India*, vol VI, No. 1, 60 pp, figs 20, 1 diagr. Calcutta, Sept 1921

The authors have identified numerous subsidiary factors which influence the quantity of morphine contained in opium; their influence will be treated in a series of works beginning with the present. A summary is made of the works of different authors on the subject of the factors which influence the quantity of active principles produced by other plants and these results, taken in conjunction with those which they have themselves obtained, throw much light on the subject of the functions of alkaloids among plants.

Tables show the plot yield of opium at each successive incision and the content in morphine as well as the opium yield for 1000 capsules,

and from the experiments made in 1917-1919 to decide the question whether the quantity of morphine contained in the opium from the second and subsequent incisions can be modified by varying the intervals of time between the successive incisions, the authors draw the following conclusions:

The opium of the 1<sup>st</sup> incision is richer in morphine than that of the subsequent incisions; in practice, the method to adopt would be to collect the latex given off in the first few seconds from the surface of the capsules after the first incision. Possibly, if this first exudation of latex were removed immediately, a more copious flow of latex per capsule would be obtained in the 2<sup>nd</sup> yield made the following morning and in the succeeding yields, because the coagulation of the first deposit of latex around the surface of the incision must obstruct its free flow.

**INFLUENCE OF VARIATIONS IN THE METHOD AND PERIOD OF THE INCISION ON THE COMPOSITION OF THE OPIUM** — The method of incision varies in the different opium-producing countries; the authors describe the methods adopted in India, France, Germany, Egypt, Asia Minor, Persia, China and Australia. They compared, by experiments made on a large scale, the Turkish mode of spiral incision, the transversal, vertical, etc. From tables showing the results thus obtained and a diagram illustrating the yield in opium according to the number of blades of the lancet used in making the incisions, etc., the authors draw the following conclusions.

1) The Turkish mode of spiral incision does not give a greater yield of opium than the Hindoo vertical incision, which is much simpler. The same holds good with regard to transversal incisions.

2) There is generally no advantage in making more than one vertical scarification at each incision.

The yield of latex is not increased in proportion to the number of scarifications; if 5 or 6 vertical scarifications are made, the yield is even less than with one only. Generally, 3 scarifications per incision yield much more than is obtained by one at the 1<sup>st</sup> incision; but in subsequent incisions, the yield obtained by the first method diminishes to such an extent that the final total yield is lower with a number of scarifications than with one only.

3) If at each incision instead of making the scarification along the whole length of the capsule, it be limited to  $\frac{1}{3}$  or even less, the yield of latex is considerably less at the 1<sup>st</sup> incision. But the dry matter of this latex contains a higher percentage of morphine; further, in subsequent incisions, this percentage diminishes less rapidly.

4) An experiment for the purpose of testing the effect of the number of lancet blades used in making the incision shows that the 6-bladed lancet gives a total yield in opium per capsule higher than one with 2 or 4 blades, even to the extent of doubling it.

5) There is no difference either in the opium yield or morphine content according to whether an incision be made in the morning or in the afternoon.

6) The authors call attention to the fact that the size of the capsule and vigour of the plant have a great influence on results. It seems that a

large capsule on a vigorous plant may receive more than one scarification at each incision without suffering to any extent whereas a weaker capsule may give no latex at all if more than one scarification be made at each incision.

M. L. Y.

429 - **Influence of Solar Radiation on the Culture of Belladonna and on the Formation of Alkaloids in the Leaves.** — GORIS, A., and DELMARD, A., in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 3, pp. 183-190 Paris, January 17, 1922.

After cultivating the belladonna: 1) in the sun; 2) 6 weeks in the shade and then 6 weeks in the sun; 3) in the shade; and after gathering the leaves on the appearance of the first 2 or 3 flowers, the authors have observed that the leaves of group 1, at the 1st gathering, contained 0.65% (taking the weight of the dry leaves) of alkaloids, and on the 2nd gathering, 0.52%; the leaves of group 3 only contained on an average 0.30%. Further the adult plants grown in the sun yielded 3 crops from May to September, whereas the plants of the 2nd group required 3 months before yielding a crop. Finally, the plants grown in the sun yielded an average of 15 gm. of dry leaves each, those grown in the shade, 9 gm. only. Speaking generally the plants grown in the sun, as compared with those grown in the shade yielded 3 to 4 times as many leaves and 7 to 8 times the quantity of alkaloids.

F. D.

430 - **Interplanting of Trees on Coconut Estates. Observations made in Portuguese India.** — FURTADO, C. N., in *The Planter's Chronicle*, vol. XVI No. 13, pp. 219-222 Coimbatore 1921.

The author as a result of observations made at Goa, has found it possible to catalogue the trees which may be allowed to grow on coconut estates with obviously advantageous results.

It should be noted at the outset that coconuts in Goa are usually grown on lateritic or sandy alluvial soils, which retain very little humus; the sub-soil is inclined to be compact and to contain a detrimental excess of moisture. Consequently a careful selection of trees for interplanting, employing deeper rooted varieties than coconut, thus rendering the sub-soil less compact, and varieties which from the point of view of foliage will serve as a useful source of humus, is of undoubted benefit to the plantation in general.

**LIST OF TREES RECOMMENDED** — "Banyan" (*Ficus indica* Roxb.), "Indian coral" (*Erythrina indica* Lamk.), "hogplum" (*Spondias mangifera*), "horse radish tree" (*Moringa pterygosperma* Gaertn.), "belembi" (*Averrhoa Bilimbi* L.), "mango" (*Mangifera indica* L.), "pomelo" (*Citrus decumana*), guava (*Psidium Guyana* L.), "malay apple" (*Eugenia mallaccensis* L.), "box" (*Ficus glomerata*). The last mentioned is chiefly grown along the borders of drains, tanks etc.

In addition to this list, the following, is also given of the trees considered undesirable:—

Portia tree (*Thespesia populnea* Correa), tamarind (*Tamarindus indica* Linn.), teak (*Tectona grandis*), red silk cotton tree (*Bombax Mala-*

*baricum* D. C.), "cashew" (*Anacardium occidentale* L.). "poon" (*Sterculia foetida* L.), "jajube" (*Zizyphus Jujuba* Lamk.), and *Mimusops Kinki* L. M. L. Y.

431 - **The Cultivation and Commercial Possibilities of Safflower Seed (*Carthamus tinctorius* L.) in India.** — HOWARD, A (Imperial Economic Botanist) and REMINGTON G S (Consulting Chemist, Aynsme Technical Laboratories, Grange-over-Sands, Lancashire): in *Agricultural Research Institute, Pusa, Bulletin* No 124, pp 1-14. Calcutta 1921 — and *The Chamber of Commerce Journal*, Vol XI,III, No 418, p 81. London, Feb 3, 1922

The safflower (*Carthamus tinctorius*) is widely cultivated in India both as an oil seed and to a much less extent for the reddish dye in the flowers (carthamin). Open sandy and rather dry soils best suit this crop, which is generally sown mixed with grain, barley or wheat.

Various species have been isolated and studied at Pusa, and the author gives a classification of 24 types with notes concerning their general habit, leaves, bracts and flowers, and the percentage oil content of each type respectively

A number of seed samples have recently been analysed at Poona by MANN and KANTIKAR with the following average result. — husk 50.8%; kernel 49.2%; oil in the whole seed (average of 55 samples) 31.6%; maximum 36.9%, minimum 25.4%. The various constants of safflower oil were determined and particular attention paid to its characters after heating under well defined conditions. Apparently it is only at 300° C in oxygen that the well known characteristic results of heating the oil become evident. By heating to 186° C in oxygen, a very marked reduction in the length of time required for drying was obtained.

Testing investigations were made in Great Britain under the direction of the author REMINGTON into the commercial possibilities of safflower. Reference has already been made to this work in the Scientific Reports of the Agricultural Research Institute, Pusa 1920-21 (1), but the author here gives full details of the various tests carried out.

The economic uses of this oil have already been summarised (1) and it is also stated that it can be utilised with success as a substitute for oil in paints and varnishes.

In India, the meal should be used to best advantage in the manufacture of soaps, or as a slow acting manure for agricultural purposes. An analysis of the meal was made with the following results: % moisture 7.50, oil 2.21, albuminoids 15.96, carbohydrates 35.48, crude fibre 32.88, mineral ash 5.97. As feeding material however the meal should be considered useless on account of the high crude fibre content.

Although the investigations so far undertaken have proved undoubtedly the high economic value of the safflower, further investigations are in progress in the Pusa laboratories as to the protein value of the seed, etc. M. L. Y.

(1) See R. MATCH 1922, No 227 (Fd)

432 - **The Cultivation of Capsicums in Algeria.** — GIBIER L., (Conseiller agricole à Orléansville) and FOURNIER F. (Chef de la Station expérimentale de Ferme-Blanche (Oran), in *Revue Agricole de l'Afrique du Nord*, Year 20. No. 131, pp. 76-78, figs. 2. No. 132, pp. 96-98. No. 133, pp. 109-110. Algiers, Feb. 1922.

HORTICULTURE

During the last three years, distinct progress has been made in Algeria with regard to the production of capsicums, especially in the Perrégaux region, which possesses a sandy loam particularly adaptable to their cultivation. The area covered from 1919-21 is given as 130 hectares.

The recent establishment of several factories, specially constructed for the manufacture of red pepper, pickles etc. has done much to emphasise the industrial value of capsicums and the authors state that should the drying processes and the methods of cultivation in general, be perfected, there is every possibility of obtaining a condiment of first-class quality which should rank with the best produced in Spain which is recognised as the leading country for red pepper.

The actual varieties cultivated are not clearly defined, but the following classification has been found possible.

The Dwarf Red Tomato var., almost spherical in shape; scarlet; pungent taste. This is the chief variety grown (80 ha). Three crops per year are obtained in June, end of September and in November or December; used for red pepper.

2) Improved Bull-nose or Sweet Mountain var., large fruits, blunt, with squared ends; furrowed; thick flesh, mild flavour. Used for pickles or eaten fresh.

3) Long Red Spanish pepper: flavour strong, cultivated in Orléansville.

4) Cayenne pepper, small; red; shape slightly curved; strong and burning flavour. Chiefly used by natives, but not often for commercial purposes.

The best results have been obtained on light soils, rich in humus, especially on the sandy loams in Perrégaux. Ploughing takes place twice, in December and in early March, and directly after the second ploughing, ridges are made 40 to 70 cm. apart. Farmyard manure is applied at the rate of 10 000 to 25 000 kg. per hectare; the addition of leaf mould has in some cases been found advantageous.

Sowings are made in December or January, and the seedlings are ready for transplanting towards the end of March or in early April, and are planted about 30 cm. apart in some cases and more thickly in others (20 to 25 cm.). Of the two methods employed viz. 1) flooding the furrows previous to transplanting and 2) leaving the furrows without water until later, the first has proved the more satisfactory.

During the growing period, frequent waterings are given in the early stages and afterwards at intervals of 15 to 20 days up till the fruiting stage; from which time onwards, until cropped, only 5 to 10 days is considered necessary.

The cultural operations are limited to two or three hoeings.

The harvest season starts towards the end of June and continues

until the beginning of January, but the later ripening fruits are of inferior quality.

A description is given of the drying process employed for the capsicums intended for red pepper manufacture and also for pickles etc. In the first case, the waste product is estimated at 6 to 7 % of the total weight of dried capsicums. In the second case usually about 50 days are allowed before the preserves are taken out of the hermetically sealed recipients, which are then bottled for sale. The prices obtained in Algeria are subject to considerable fluctuations, but the following average for three years is given: dried capsicums, 300 to 400 frs. per quintal; fresh capsicums: 25 to 70 frs. per q.

As regards cost of production and net profit per hectare, an estimate is given for the Perrégaux district in 1921 (in francs): land rent 70; soil preparation 70; ridging 20; manuring (20 qx at 5 frs. per q.) 100; transport of manure etc. 50; collection of plants and transplanting 70; hoeing and weeding 300 (15 to 18 frs. per person per day); thinning out fruits, 30; irrigation, 60; manual labour for about 20 waterings, 150; cropping (collecting of 200 qx of capsicums at 2 frs. per q.) 400; general costs 150. Total 1470 frs.

The average yield per hectare is estimated at 200 qx. of fresh capsicums and the total value should be 5000 frs., taking the average sale price at 25 frs per q. The net profit should be therefore 3430 frs. per hectare.

In Orléansville, the net profit, however, is lower, not exceeding 800 frs per ha. and the industry appears to be gradually dying out in this district.

M. L. Y.

433 - Possibilities of the Mushroom Industry in India. Bosc S. R. (Professor of Botany, Carmichael Medical College, Calcutta), in *Cultural Journal of India*, vol XVI, No. 6, pp 613-617 Calcutta, Nov 1921

Up to the present time there has been no regular cultivation of edible mushrooms in India, but as a result of the author's investigation as to the nutritive value of the indigenous wild varieties it appears highly probable that mushroom growing will become a special industry in India.

A chemical analysis has been made of the most common edible varieties found in Bengal and it is to be noted that some of them are superior to the English mushrooms etc. as is shown in the following Table.

Species	Protein	Carbo- hydrates	Fats (Ether extracts)	Ash	Moisture
					analysed in dry con- dition
<i>Volvaria terastus</i> . . . . .	2.28	trace	0.18	—	—
<i>Collybia (Leptota) albuminosa</i> . .	12.8	14.8	trace	—	—
<i>Agaricus campestris</i> . . . . .	2.1	1.60	0.37	0.15	95.2 %
Puff balls ( <i>Gasteromycetes</i> from Bankusa) . . . . .	2.20	1.35	0.56	0.16	93.85
English edible. . . . .	0.18	0.46	0.03	—	—
American Edible. . . . .	2.25	4.95	0.20	—	91.30



The tissue culture method in sterilised dung medium has been adopted to obtain artificial cultures of these local Agarics. The object is to make native spawn and thus facilitate production on a large scale and consequent economic development.

The results of an enquiry instituted by the Royal Botanic Gardens, Kew, prove that there is a ready market for edible mushrooms in Burma, Punjab, Kashmir and Afghanistan, provided that a regular supply is forthcoming.

M. L. V.

FRUIT  
GROWING

434 - **The Avocados of Guatemala.** — LEITCH, MARIE and LEITCH, MARQUERITE, in *Revista de Agricultura de Puerto Rico*, Vol. VII, No. 4, pp. 5-35, figs. 10, San Juan, October, 1921.

The Guatemala varieties of Avocados (*Persea gratissima*) differ from those of Porto Rico origin in various ways: 1) The former have a thick rind and adherent stone, which enables them to be exported, while the native varieties have a thin skin and the stone moves about in the cavity, so that the interior of the fruit is injured during transport.

2) Many of the Guatemala varieties grow as high as mango-trees, and are therefore able to bear more fruit than the native varieties.

3) Some Guatemala varieties fruit at different seasons, spring, summer, autumn or winter; thus, ripe avocados can be obtained throughout the year.

4) The Guatemala varieties are much richer in fatty substances than the native kinds. According to the variety, the former contain 16 to 30 % of fatty substances (1) and the latter only 10 %.

5) The Central American varieties fruit much earlier; the "Lyon" variety is mentioned as bearing fruit in the nursery, and is said to produce a crop from the age of 4 years. The "Puebla" variety begins to bear when 2 years of age, like "Puerta" which, when it is 4 years old, produces 100-300 fruits per tree while the "Spinks" variety fruits 3 years after being grafted.

6) A large number of Guatemala varieties bear fruit at high altitudes in their native country at from 900 to 1200 and even 1500 metres above sea-level. The Porto-Rico varieties, on the other hand, are sterile at high altitudes. Thus, the deforested hills of Porto Rico could be covered with woods of "aguacates", and a profitable crop might be obtained.

7) The Guatemala varieties are usually resistant to strong winds.

8) Some of these varieties produce good wood and dense shade, which makes them useful in the Guatemala coffee plantations. Two crops can thus be obtained on the same ground. These trees can bear a great number of fruits without damage to their branches.

6) The fruit of several of these varieties can be left hanging on the tree for some months.

Of the 30 varieties of Guatemala avocados, that have been imported

(1) See *R. Sept.* 1920, No. 8:28. (Ed.)

into Porto Rico (Plantación de Mangos y Aguacates de Bayamón), 5 are specially recommended for growing for the market; these are: *Fuerte*, *Spinks*, *Dickinson*, *Sharpless* and *Puebla*. Their characters are as follows: *Fuerte*: fruits from January to August. Weight of fruit 325 to 400 gm. contains 30.72 % of fatty substances.

*Spinks*: fruits from April to August; weight of fruit 450 to 560 gm. contains 21.75 % of fatty substances.

*Dickinson*: fruits from June to October: weight of fruit 330 gm. contains 20.36 % of fatty substances

*Sharpless*: fruits from October to February; weight of fruit 560 gm. contains 24.23 % fatty substances

*Puebla*: fruits from December to February; weight of fruit 225 to 280 gm.; contains 26.68 % fatty substances

Among the other varieties may be mentioned: *Lyon*, *Dickey A.*, *Perfecto*, *Atlisco*, *Mérito*, *Grande*, *Taft* and *Blakeman*

The same variety cannot be obtained from seed and hence grafting is necessary. As *Persea gratissima* grows into a large tree, it should be planted at intervals of 9 or even 12 metres, if the soil is very fertile. The same precautions must be taken as in planting a fruit-tree in the orchard: the hole should be 60 cm deep and 1 m wide, the soil must be mixed; with well decomposed dung and compost, and then filled up to form a mound 30 cm in height, and 1.50 m in diameter, etc. When once planted, the young tree must be protected from the wind and sun by means of canvas, or palm leaves; this shelter is no longer necessary after it has taken root and a new bud has developed. It must, however, be protected against the wind for at least a year.

It is advisable to place dry grass round the tree and this should be changed every 3 months. A prop is indispensable, for the tree must grow perfectly straight. It should be watered in dry weather.

The analysis of the edible pulp of the "aguacate" gives the following results (1): Water 72.8 %, protein 2.2 %, fatty substances 17.3 %; carbohydrates 3.4 %, crude fibre 1.9 %, ash 1.4 %. The avocado is thus a fruit of considerable food value and is eaten in large quantities by the working classes of Guatemala.

The cultivation of *Persea gratissima* in Porto Rico is likely to develop considerably, not only on account of the actual value of the fruit, but because of the possibility of exporting it to the United States. Porto Rico is the only tropical possession of the United States which is near enough to satisfy the demand for avocados, as both the Philippines and Hawaii are too far off.

P. C.

435 - **Propagation of Date Palms by Seed.** - TRABUT, in *Comptes rendus de l'Académie d'Agriculture de France*, Vol VII, No 33, p 718-721. Paris, October 1921.

The date-palm is generally propagated by cuttings taken in the spring. These cuttings, however, do not always strike, and are in any case, very

(1) See *R. Sept* 1920, No 828 (*Id*)

liable to be infested by parasites, especially by the scale-insect, *Phoenicococcus marlatti*, which attacks the cuttings before they are planted out.

On the other hand, date-palms are easily propagated from seed, but in this case, the characters of the variety, especially when it is a good one, are not reproduced in their entirety. Date palms are dioecious, and when fertilised artificially, the offspring is directly influenced by the parents. The natives, however, never take into consideration the origin of the pollen. For some years past, male palms with all the characters of the "deglet nour" variety (which is much in request for export), have been observed in the American Experiment Stations.

The female date-palms fertilised with the pollen of these valuable male trees have produced offspring similar, except for some slight variations, to their parents. The author has received some "deglet nour" pollen from America and used it at Biskra for fertilising bunches of the same variety. The dates thus obtained are very fine and have a smaller stone than the fruit of bunches fertilised with the pollen used in the district.

Thus date-palms bearing choice fruit can now be obtained from seed, which is very economical, for a date-palm raised from seed bears fruit sooner than one grown from a cutting, and it also makes a more vigorous tree.

P. C.

436 - **Fruit Trees that can be Interplanted on Coconut Estates** — See No. 430 of this Review

437 - **Viticultural Questions in Italy.** — I. SANNINO, F. A., La Luglienga, in *Rivista di Improbabilità*, Year II, No. 9, pp. 129-131. Alba Livorno, September 1, 1921. — II. PIRIVANO, A., Profumo sintetico di Moscato, *Ibidem*, pp. 131-135. — III. SANNINO, F. A., Il vitigno portoghese bleu in Italia e all'estero, *Ibidem*, No. 10, pp. 145-146, October 1, 1921. — IV. PIRIVANO, A., Port'innesti italiani, *Ibidem*, No. 12, pp. 177-180, December 1921. — V. SANNINO, F. A., Uve da tavola, *Ibidem*, Year III, No. 1, pp. 3-11, January 31, 1922. — VI. ZERIOLI, F., Le principali uve da tavola che l'Italia esporta, in *L'Italia viticola ed agraria*, Year XIII, No. 10, pp. 148-150. Casalmongera, March 5, 1922. — VII. *Idem*, La nostra esportazione di uva da tavola in Svizzera, *Ibidem*, No. 6, p. 132, February 26, 1922.

VINE GROWING

I. — "Luglienga" is a white grape peculiar to Piedmont where it is cultivated even in the valleys of the Alps.

It is also known in Lombardy and even better in Venezia, where it is grown under the name of "San Giacomo".

The vine is distinguished by its early ripening and has to be trained on trellises.

Luglienga must be pruned for long canes, but if the stock is prolific, bunches of fruit are seen on the shoots of the spurs and also on the shoots of the vertical portion of the fruit stock, shewing that the lower buds are fertile. The author mentions the case of a vine-grower who trained "Luglienga" at Milazzo (Sicily) on horizontal cordons, and made an annular incision in the fruit buds of the spurs; he gathers the grapes at the beginning of July, before the Algerian and Tunisian grapes are ripe.

Manuring with potassic salts (to increase the sugar content and diminish the acidity), was more successful than annular incisions in securing early ripening.

The cultivation of this table grape, which for one month has no rival on the market, is most profitable, and the author advises its extension.

Average weight of ripe bunch 192 gm.; must composition: sugar 17.92 %; total acidity 5.70 per 1000; cream of tartar 4.28 per 1000.

II. — PIROVANO states that he detected the Muscat aroma in 2 hybrids I. P. 6 and I. P. 7 fertilised with the pollen of "Ferdinand de Lesseps" which had been obtained in England by PEARSON from a cross between a white Chasselas and Isabelle or strawberry grape. Isabelle has a foxy taste which is much less noticeable in Ferdinand de Lesseps (in which it is transformed into a pleasant flavour) and still more slightly in these hybrids which have a muscat aroma. Special mention should be made of the "hybrid Pirovano 7" (I. P. 7), the result of the cross "Madeleine royale" × "Ferdinand de Lesseps". It is a very early, strong prolific vine, though not without defects. It becomes weakened by grafting on an American stock, or a European × American hybrid, and like all the varieties of *V. Labrusca* and their hybrids, is subject to tillosis. Long-lived and productive vines can however be obtained by a careful choice of the soil, stock and fertiliser.

III. — Prof. SANNINO calls attention to the good qualities of the blue Portuguese vine, which is characterised by the early ripening of the fruit and the fact that its grapes are suitable both for the vat and the table.

PULLIAT has recommended it for cold districts where it can replace early varieties, such as Pinot and Gamay, being quite as early and more productive. The author advises its use for supplying vat grapes for cold districts in place of Dolcetto (1), for it is more vigorous, and perhaps hardier, while its grapes do not drop so easily.

The author gives the ampelographical characters of this vine which produces purplish-black grapes. Even the lower shoots bear fruit, so that it can be pruned short. As the blue Portuguese vine is very strong-growing and productive, the plants must not be placed too close together. As it is subject to anthracnose, it should be allowed to reach a certain height in districts where the spring is wet. The best results are obtained by growing this vine on warm slopes with a good exposure; at Alba, it does well on hills with a very clayey soil. The vintage of September 1921 produced at Alba a must with the following composition: sugar 19.70 %, total acidity expressed as tartaric acid 5.9 per 1000; cream of tartar 4.78 per 1000. It is desirable to add some bisulphite of potassium during fermentation, as by this means a wine of good colour, with red effervescence and greater acidity is obtained.

This vine is much grown in the neighbourhood of Vienna, and at Mons and Schumberg, where it produces an ordinary table wine of good quality. It is grown in Hungary under the name of "Oporto". The wine

(1) See R. 1920, No. 660. (Ed)

made from the produce of vineyards on the plain has an earthy flavour, but when grown upon the slopes of Transylvania these grapes yield a wine with a clean taste. It is alcoholic, full bodied, soft and well coloured, lacking in acidity and tannin. Under the name of "Plant de Porto" this vine has been largely grown in Champagne in the vicinity of Epernay, where it produces a highly-coloured, full bodied wine. It yields fairly early table grapes which are ready for eating in August, though they are then completely ripe, for the pulp is not very acid, and the flavour not is pleasant, if not very sweet.

IV. — PIROVANO mentions two stocks that he has obtained: 1-37, or "Golia" (1), and 2-59, or "Gagliardo"; they are derived respectively from the crosses 15 612  $\times$  Rupestris du Lot and 15 612  $\times$  Riparia 420 A. 15 612 was obtained by CASTEL and is a product of the cross Carignan  $\times$  Riparia. Both have an excellent grafting affinity and the diameter attained by the stem is equal to that of European vines. They are also resistant to drought but their chief characteristic is extraordinarily vigorous growth.

Golia does best on acid, heavy, poor soils with a lime content not exceeding 40 %. Its luxuriant growth makes this vine unsuitable for rich soils, unless it can be allowed to develop freely; it could be used to make arbours, as it would cover them very quickly.

Gagliardo can bear the same amount of lime and is suited to damp soils where Riparia  $\times$  Rupestris would grow well. The latter runs it very close as regards vigour, and has a closer affinity to European vines.

V. — The author calls special attention to the desirability of developing the cultivation of table-grapes, both as a remedy for over-production, and in order to keep up the price of wine (to insure a fair profit) by decreasing its production.

Basing his advice on his personal observations and on those of Prof. V. RACAH (*L'Italia Agricola*, 1921, No. 12, p. 375), he recommends the following vines: Golden Chasselas, which grows admirably in Tuscany — Luglianga — Précoce de Courtilier (with Muscat flavour) — Madeleine Royale — Panse précoce — Madeleine angevine — Précoce de Malingre, all earlier than Chasselas — Colombana, or S. Colombana for districts near the Tyrrhenian Sea (over 30-40 kg. from the coast the grapes lose their beautiful golden colour) — Salamanna or Alexandrian Muscat which corresponds to the Muscat of Calabria, and the Zibibbo of Sicily — Catarratto Cerletti Muscat for Sicily and Apulia.

VI. — The following information has been taken from a report presented by Filippo ZHRIOLI, a great exporter of Italian grapes, to the "Commissione vinicola" at the Ministry of Agriculture.

MILAZZO. — *Chasselas* (bunch regular, skin thin, berries large; gathered middle of July; yield in 1921, 2000 quintals; vineyard reconstituted on American stocks; countries of consumption: Switzerland,

1) See R. Nov. 1921, No. 1127 (Ed.)

Germany — *Varesana* (bunch regular, berries large, fleshy, hard skins, resistant) vintage, early in August.

BARI. — *Chasselas* vintage early in August; yield in 1921, 1000 quintals, zone infected with phylloxera, vineyard in course of reconstruction; country of consumption: Germany, especially Saxony. Before the War another grape, the black "Tarantino" vat grape, was also sent to Saxony as a table fruit; during the War exportation was suspended and has not been resumed on account of the high cost of production.

LECCE. — *Varesana*, *Somarello*, *uva Rosa* (bunch regular, large berries, fleshy, hard skin, resistant); gathered early in September; yield in 1913, 40 000 quintals, in 1921, 15 000 quintals. Same observations as in the case of Bari.

NAPLES. — *Catalanesea* (bunch irregular, grapes large, yellow, fleshy, skin hard); vintage late; places of consumption: Naples, and in some years, to a small extent, Milan. An attempt has been made to send these grapes abroad, but the consignments had to be discontinued as the fruit does not bear transport.

TERRACINA. — *Muscat* (yellow, scented grape, bunch irregular, skin hard, berry medium size, vintage from middle of August to early in September, production in 1913, 35 000 quintals, in 1921, 45 000 quintals, vines immune to phylloxera. In 1897, an attempt was made to export these grapes, but they were found to travel badly, and at the same time their flavour is not appreciated in Germany.

TERAMO AND CHIETI. — *Trebbiana* (bunch irregular, berry average, colour golden yellow): gathered the first 10 days of September; yield in 1913, 45 000 quintals, in 1921, 45 000 quintals. — *Mondovico* (large, compact bunch); vintage end of September; yield in 1913, 8 000 quintals, in 1921, 8 000 quintals: sent to Switzerland, Germany and some Italian towns, especially Milan. Before the War, "Montepulciano" (a red vat grape), was also sent but the consignments have ceased owing to the high cost of production.

SAN SEVERO. — *Trebbiana* (compact bunch, small yellow grape), vintage middle of September: markets Switzerland and Germany. It has not been exported since 1913, owing to its high price.

BOLOGNA. — *Chasselas* (bunch compact, skin thin, grapes rather large); vintage in middle of August; yield in 1913, 30 000 quintals; in 1921 10 000 quintals; grows in phylloxera infected zone, vineyard under reconstruction: sent to Switzerland and Germany. Before the War, "Negretto" (a red vat grape), was also exported as a table grape. — "Regida" (large yellow berries); gathered early in September.

PISA. — "Bordò," or *Golden Chasselas* (type Bolonais *Chasselas*); vintage early in September; yield in 1913, 7000 quintals, in 1921, 7000 quintals; vineyards already invaded by phylloxera and completely reconstituted; sent to Switzerland and Germany. — *Colombiana* (regular, loose bunch, thin skin, average-sized coloured berry); vintage early in September; yield in 1913, 15 000 quintals; in 1921, 15 000 quintals; markets: Switzerland, Germany, Genoa and Milan.

**PLAISANCE.** — *Bianchetta* (bunch regular, skin thin, berry average); vintage in middle of August; yield in 1913, 5000 quintals, in 1921, 5000 quintals; markets, Switzerland, Milan, Genoa. — *Verdea* (bunch regular, skin thin, berry average-sized, resistant); vintage middle of September; yield in 1913, 32 000 quintals; in 1921, 10 quintals; phylloxera-infested zone; vineyard being reconstituted; markets: Switzerland, Germany, Genoa and Milan. These grapes are kept in a room on screens and sent to the markets of Genoa and Milan until April. — *Bazzegano*, or *Besgano* (red table-grape, bunch regular, berry large, fleshy, skin hard); vintage in the middle of September; yield in 1913, 4 000 quintals, in 1921, 4 000 quintals; markets: Switzerland, Germany, Genoa and Milan.

**ALBA** (Piedmont). — *Angela* (large berries, thin skin); vintage late; yield in 1921, 5 000 quintals; markets: Genoa, Turin and Milan. This grape is kept on screens all the winter.

VII. — The annual exports of table-grapes from Italy to Switzerland from 1914 to 1921 were (in quintals) — 23 566 — 14 210 — 19 633 — 13 572 — 83 447 — 22 769 — 29 491 — 61 261; while from France, from 1919 to 1921, they were; 5 797 — 31 993 — 15 382. In 1913, Italy sent 74 000 quintals of grapes to Switzerland, and 387 000 quintals to Germany.

F. D.

438 — **Substituting Shield Grafting for Double Cleft Grafting in Vines.** — FERRICHELLI, E. (Consorzio viticolo Trani), in *Giornale vinicolo italiano*, Year 48, No. 8, pp. 72-74 Casale Monferrato, February 19, 1922

Shield-grafting, for some years declared by the best known authorities on vine-growing to be the type of grafting least suited for the re-establishment of vineyards, is now coming increasingly into favour, on account of the good results obtained by many Sicilian vine-growers. The author especially recommends it in its whistle and ring forms, but he does not approve of shield budding or bud-grafting as this form is not sufficiently firm.

The English or double cleft graft unites firmly and the scion grows well for a certain number of years; it does not, however, guarantee long life for the stock owing to the frequent hypertrophy of the tissues at the point of union and the difference in the diameter of the scion and stock which is thereby induced.

Ring grafting affects only the zone of tissues which readily makes second growth (phloem parenchyma and cambium), whereas in double cleft grafting, the incision nearly always severs the supporting tissues from the wood-vessels which cannot be directly united.

The "quatre-lames" generally used is not suitable for making a whistle-graft; and a "tenailles Ottavi" is to be preferred for the purpose. In this implement there are two short-cutting, semi-circular blades fixed at the right distance, which clasp, by means of a strong spring, the branch to be grafted. Thus the instrument cannot swerve from the plane of the cut and if a simple, rotary movement of rotation is given to the pincers, 2 perfectly circular cuts are made on the branch and when these are

completed by the longitudinal cut, the ring of the cortex with its bud can be easily detached.

F. D.

# FORESTRY

439 - **Forestry in Norway and the Official Efforts for its Advancement.** — BJANES, O. T. (Director of Agriculture, Department of Agriculture), in *A Short Review of Agriculture and Forestry in Norway and of Official Efforts for their Advancement* (issued by the Department of Agriculture), 64 pp., figs. 9. Christiania, 1921.

Forest lands cover a considerable portion of the area of Norway, namely over 7 million hectares. The principal forest trees are: Spruce fir (*Picea excelsa*), Scots pine (*Pinus sylvestris*), birch lowland birch *Betula verrucosa* in the low-lying districts and mountain birch *Betula odorata* in the highland districts; *B. nana* covers large tracts of land in the high mountains. In addition to these three types of tree there are also to be found the following: ash (*Fraxinus excelsior*), oak (*Quercus pedunculata* or *sessiliflora*), beech (*Fagus sylvatica*), lime (*Tilia parvifolia*), alder (*Alnus glutinosa* and *incana*), aspen (*Populus tremula*) and several other species.

Considering the northerly situation of the country, the forests extend to a great height above sea-level; in the Eastland, conifers grow up to an altitude of 900 metres and deciduous trees (birch) to 1100 to 1200 m.

The conditions of working are facilitated to a considerable extent by the long winter with its settled weather and good transport conditions, and by the many water-courses which are suitable for carrying timber. The working of the forests therefore, in spite of the mountainous character of the country, may be described as easy. Owing to the great extent of the forest area, a comparatively large number of workers can be employed on the land during the whole year, for the work in the woods is chiefly done in winter, while the summer is the busiest time for agriculture.

The output of the forests far exceeds the country's own requirements and there is thus a large export of timber and other forest products, especially wood-pulp and paper. In the last few years, the annual export of timber has risen to about 1,300,000 cub.m; 700,000 tons of wood-pulp; and some 200,000 tons of paper and cardboard. There are in Norway 119 wood-pulp mills, some of them very large, and a great number of saw-mills and planing mills.

Most of the forests (about 84 %), are in private ownership, 48 % belonging to farmers, while 36 % are worked independently of agriculture. About 16 % belong to the State, and other official or semi-official institutions.

The work of the Government for the advancement of forestry and agriculture comprises; the official measures put into operation by the State Administration for agriculture and forestry: the work that is carried on by agricultural and forestry associations; forestry instruction.

The Department of Agriculture has 2 divisions, each of which has its executive Chief: 1) The Agricultural and Concession Division; 2) the Forestry and Veterinary Division. The latter has the following branches: Forestry, Reindeer and Freshwater Fisheries, Land Re-distribution, Veterinary.



All public administration relating to forests and forestry comes within the purview of the Forestry Office. The Director of Forestry is in charge and stands in the same position towards the Department as the Director of Agriculture. In addition to the administration of the woods and forests in general the Director of Forestry is responsible for the business management of the forests belonging to the State which comprise a comparatively large area, as will be seen below. The Office is divided into a technical and a legal section, as in the case of the Agriculture and Production Offices. Under the Forestry and Veterinary Division are 3 Forestry Inspectors of whom, however, 2 only have offices in the Department.

The Agricultural Societies are grouped in an Institution known as "Det norske Landbruksraad" (The Norwegian Agricultural Council), in which "Det norske Skogselkap" (The Norwegian Forest Society), and the "Norske Skogeierforbund" (Norwegian Forest-Owners' League), each have 2 representatives.

In addition to the 3 Inspectors of Woods and Forests mentioned above, 40 forest-managers, 20 assistants and about 500 wood-rangers are under the Control of the Director of Woods and Forests, all of whom are entirely in the service of the State. The Director also has the control of the following Bureaux that are carried on entirely for State purposes: The State Forestry Valuation Office: this office regulates the boundaries, and makes surveys, valuations etc. of the public forests and of the forests offered for sale to public Authorities. The permanent Staff consists of 2 forest valuers with 4 assistants.

The National Valuation Office for Forests, has been established for the purpose of furnishing, by means of direct measurements and investigations, statistics regarding the Norwegian forests. Its work consists in the first place in supplying answers to the following questions: 1) the area of forest and its distribution according to the different species and qualities of timber; 2) the existing supply of growing timber; 3) the amount of the current yearly increase, etc.

The work in the field proceeds by counties in the form of lineal valuation.

The permanent Staff of the National Forestry Valuation Office consists of 2 forest valuers together with the Office Staff. The other officials for the field-work are engaged every season.

According to the general scheme, the valuation is to be completed in the course of 5 years, for 9 of the largest forest-growing counties in the country. During the same period, the census of the forestry industry is to be carried out throughout Norway in order to ascertain the annual production of all the forests in the country and the consumption for household purposes. In this connection, returns are collected from all the forest properties in Norway giving the output for 3 consecutive years.

The State founded in 1917 an Experimental Station for Forestry at Aas near Christiania. The Staff at present consists of 2 experimentalists and 2 clerks.

There is also an Experimental Station for Forestry affiliated to the

Bergen Museum, the principal contributor to its support being the Norwegian Forestry Society.

The State supports in various ways the work required for the preservation and renewal of the forests. Large nurseries of plants for sale have been established in various parts of the country. The State has also erected seed drying-rooms in several districts.

Since 1872 the State has been planting the treeless wastes in Vestland and has regularly carried on cultivation work in its own forests. It has planted altogether on the moors of Vestland 3709 hectares of forest, which has, generally speaking, thriven very well. The State also makes grants for private plantation and for plantation carried out by local authorities. The latter can also obtain for the purchase of ground for planting, loans free of interest and of repayment of principal for 30 years.

In regions that are poor in woods, and in districts where it is to be feared that the forests, owing to their northerly situation or great altitude may die out if neglected, the State aims, if possible, at acquiring the forests to secure their preservation.

The Norwegian Forestry Society ("Det norske Skogselskap"), founded in 1898, is one of the Forestry Associations with a semi-official character; it depends partly upon private funds and partly upon grants from the State. Its objects are to diffuse information regarding the afforesting of treeless tracts and the advancement of Norwegian forestry in general. Dependent upon this Society are the local forestry societies (1 in each county). The County Forestry Societies have in their service about 50 fully qualified officials who give gratuitously to forest owners advice on all matters concerning forestry, in the same manner as an Agricultural Official gives advice on agricultural questions.

Through the forestry societies the State gives grants for the planting of forests both to private owners and local authorities.

The Norwegian Forest-Owners' Union is an amalgamation of the local associations of forest owners which are to be found in most of the forest districts throughout the country. It was founded in 1913, with the object of protecting the common interests of forest-owners, especially as regards the sale, transport, measurement and floating of timber. The Union also gives assistance in all the more important legal questions and other matters of special importance for forestry.

Pursuant to the law of July 1, 1887 concerning the utilisation of the water-courses, those persons on whose account timber floating on a river is conducted are entitled, when the majority of them are agreed, to decide that the floating shall proceed in common and under joint management, as well as to lay down the rules under which it is to be carried out. In order that decisions regarding the adoption of a joint scheme of floatage, or alterations in the adopted rules may be valid, the majority must represent at least  $\frac{1}{3}$  of the quantity of timber floated on the particular water-course during the preceding year. The rules are subject to the approbation of the King in Council. These combinations are called Associations for Joint Floatage and have been established along most of the great water-

courses of the country, and by improving the river channels a great impetus has been given to the work. Expenses are covered by a charge upon the timber transported.

Until recently, the purchaser himself prescribed the rules for the dimensions of the timber he bought and was responsible for the measurements taken; hence in many cases, the seller was more or less at the mercy of the buyer. In order to secure a more equitable arrangement there have been established of late years, along the main water-ways, special institutions with permanent and sometimes attested measurers, who receive timber on behalf of the buyer. These institutions are called Associations for Measuring Timber and their establishment is quite voluntary. They have a Council of Management to which one half of the members are elected by the buyers and one half by the sellers, the buyers and sellers each bearing half the cost.

The Norwegian Mutual Forest-Fire Insurance Company was founded in 1912 by the Norwegian forest-owners. The Company insures the forests for a premium of 1.25 per 1000 of the sum assured in cases where forest-fire regulations have been introduced. Where such regulations have not been established the premium is 1.75 per 1000. After a period of insurance for 4 years, a reduction of 20 % is made in the premium. After a further 4 years, a reduction of 0.4 per 1000 is allowed in the form of a bonus. Most of the insured persons have thus an effective premium of 60 *øre* per 1000 *kroner* of the insurance benefit. Only the forest ground and the young wood are included in the insurance, but not timber trees. In 1920 about 65 % of the forest area of coniferous trees was insured in the Company to a total value of 259 124 000 *kroner*.

Other associations concerned with forestry may be mentioned such as: the Norwegian Timber Export Association ("Norsk Trelasteksportforening"), the Norwegian Pit-props Exporters' Association ("Norsk Propseksportørers Landforening"), the Norwegian Cellulose Association ("Norsk Celluloseforening"), the Norwegian Wood-pulp Association ("Den norske Tremasse forening") the Norwegian Paper makers' Association (De norske Papirfabrikanter Forening), and Norway's Timber Union ("Norges Trelastforbund").

The forest-owners have their own bank, the Forest-Owners' Bank ("Skogeierbanken") and a Cooperative Bank has recently been founded, The Norwegian Credit Association for Agriculture and Forestry ("Norges Kreditforening for Land og Skogbruk").

As regards Forestry Legislation, the law of August 8, 1908 for the preservation of protective woods and against the destruction of forests, with the supplementary law of June 7, 1916, may first be mentioned.

By virtue of these laws, rules have been established by Royal Order in Council for the hewing of timber in the various rural districts; these rules generally contain amongst other provisions, a clause prohibiting the cutting down of trees under a fixed minimum dimension, except where such under-sized trees are hindered in their growth, stunted, damaged or the like. The State allows one half of the expenses incurred in se-

curing the proper observation of the law. In districts where the local authorities have not of their own initiative passed bye-laws, the general regulations fixed by the supplementary law of June 7, 1916, hold good.

The Act of July 14, 1893 regarding restrictions on the use of fire in woods and fields etc., with the amending Act of 1921, lays down certain restrictions upon the use of fire in forests and enjoins upon the district Authorities the enactment of so-called "forest-fire regulations" According to these regulations, every able-bodied man in a district may be called upon to assist gratuitously in extinguishing forest-fires.

Amongst other laws may be mentioned, the Act of May 20, 1899 regarding the hunting and snaring of game; the Act of July 20, 1918 regarding the housing of men and horses engaged in forest work and timber floating. The so-called "Mountain Law" of March 20, 1920, gives to the local Authorities in the highlands the power of regulating for the parishes their fishing, hunting and pasturing rights on the commonlands belonging to the State, including also the common forest-lands; while the Act of August 20, 1915 forbids the separation from the farm-holdings of the forest and mountain tracts necessary for working the farm.

By a number of laws enacted from 1906 onwards various restrictions have been imposed upon the free right of acquiring water-falls, mines, forest, land and mountain properties, lime-pits, peat-bogs and certain other national assets.

As regards Forestry Instruction, the High School of Agriculture for Norway includes a Forestry Section and owns an estate and some forest-land on which experiments are carried out. Instruction in Forestry is also given at the Lower School of Agriculture, and in 5 State and 3 County Forestry Schools, where the course lasts for 1 year, and at 2 County Forestry Schools, attached to agricultural schools, with a 1 1/2 year's course.

For the financial year, July 1, 1921 to June 30, 1922, the Forestry Service budget was as follows: Expenditure 10 821 000 *kroner*; income 7 823 292 *kroner*. In these figures are included the expenditure and income for all forests administered by the Director of Forestry, as well as contributions to the State and County Schools of Forestry and to the Norwegian Forestry Society.

G. A. B.

440 - **Effect of Orientation upon the Success of the Transplantation of Forest Trees.** — MARTIN ZÉDÉ, in *Comptes rendus de l'Académie des Sciences*, Vol CLXXIV, No 1, pp. 61-63. Paris, January 3, 1922

When making plantations of different species of trees (firs, spruces, larches and birches), in the island of Anticosti, the author found that if the orientation of the trees was not changed, the number that did not take root was greatly diminished (from 50 % to 6-8 %). This phenomenon was perhaps more noticeable owing to the inclement climate of Anticosti (Canada).

In practice, before moving trees, it is necessary to notice their orientation, in order that when transplanted, they may be arranged in such a manner that the parts which originally faced north, may again have the same direction.

G. A. B.

441 - **Paraguay Timber Industry.** — *The Board of Trade Journal*, Vol. CVII, No. 1313, p. 104. London, Jan. 26, 1922.

The growing importance of the timber industry of Paraguay may best be gauged by the following figures showing the exports of timber during the last five years:—

Year	Logs		Sawn Timber Cub. M.	Pence Posts Pieces	Spacers Pieces	Quebracho Logs Pieces
	Rough	Trimmed				
	Tons	Pieces				
1916 . . . . .	8 608	33 000	1 315	52 513	544 221	1 006
1917 . . . . .	38 995	39 000	1 777	47 586	1 026 066	1 605
1918 . . . . .	47 710	47 228	4 533	24 980	1 234 717	522
1919 . . . . .	51 821	41 171	3 848	52 841	1 135 724	1 668
1920 . . . . .	47 222	63 314	5 852	60 281	3 138 426	269

The export of quebracho logs has greatly declined since the war, and the production is now almost totally absorbed by the tannin factories. No quebracho grows in Eastern Paraguay and the industry is confined to the Chaco Territory. The average quantity of extracts of quebracho exported during the last seven years is 24 027 tons a year (maximum 32 976 in 1919 and minimum 12 710 in 1914). G. A. B

442 - **The Timber of India and Burma** (1). — HOWARD, A. L., in *Journal of the Royal Society of Arts*, Vol. LXX, No. 3613, pp. 238-248, figs. 6. London, Feb. 17, 1922.

The author made an extended tour in 1921 through some of the chief timber-producing areas of India, Burma and the Andaman Islands, with the object of gauging their possibilities for trade development.

From nearly 2500 different species to be found in these forest areas only a small proportion are of economic interest, and scientific knowledge concerning them has up till now been limited and very few of the trees have been known to timber buyers elsewhere. The somewhat vague term "teak and jungle-woods" has in many cases proved detrimental to the trade, seeing that in these so-called "jungle-woods", logs of much value are to be found superior even to the finest mahogany, or satin wood, and boxwood known.

The author has selected a few of the most outstanding specimens, and describes their commercial value (2).

1) Laurel wood, *Calophyllum Inophyllum* Linn — a dark reddish-brown wood with a handsome wavy grain. Its durability compared with walnut, for which it may prove be an excellent substitute, may be regarded as beyond question.

2) Gurjun (*Dipterocarpus turbinatus* Gaert) and other *Dipterocarpus* spp.. Found in Burma, Chittagong and the Andaman Islands. This

(1) See *R. Jan.* 1919, No. 1. (Ed.)

(2) Supplemented by notes on the given specimens taken from *Timbers of the World* by A. L. HOWARD, Macmillan Co. 1920)

timber is available in very long lengths and large sizes, free from any defect, and according to the results of the breaking tests, it has proved to be stronger than oak (*Quercus pedunculata* Ehrh. and *Q. sessiflora* Sm.). It is apparently not possible to break the wood right through; two pieces continue to remain jointed together by what appears to be a tough outer skin which forms a kind of hinge. For joinery and carpentry work etc. the wood should first be thoroughly seasoned and whenever possible sawn on the quarter, which prevents shrinking. It makes a beautiful flooring and has also been utilised advantageously for panelling etc.

3) Indian Silver greywood. This varies in shade, but possesses a permanent coloration, in which respect it differs from the so-called "greywood" or stained sycamore which up to the present has been so much in use. A careful selection of the different colour varieties gives a very harmonious effect for parquet flooring, furniture etc., and the commercial value is highly estimated.

4) Pyinkado (*Xylia dolabriformis* Benth) — the iron wood of Burma, hard, heavy, strong and durable. The thick oily substance in the pores has a tendency to exude on to the surface after the wood has been worked which may be conducive to durability, but has certain drawbacks when the wood is used for flooring.

The wood is chiefly used for railway sleepers, but it has also proved very valuable for building purposes. Though it is so hard, it can be sawn and worked without much difficulty when comparatively fresh.

5) Padauk (*Pterocarpus* spp.). — The Andaman padauk (*Pt. dalbergioides* Fock.) (syn "vermillion wood" and "East Indian mahogany") — very strong and durable, hard and firm, does not split, shrink or expand with any climatic change; the wood possesses a brilliant lustre which distinctly adds to its commercial value when utilised for making furniture etc.

The padauk of Burma (*Pt. macrocarpus* Kurz.) is of a duller colour, but possesses strength, toughness and elasticity to a marked degree.

Both types of padauk have been approved by the Admiralty as a substitute for "sabicu" (*Lysiloma Sabicu* Benth) in the construction of battleships.

6) Indian Boxwood (*Canthium didymum* Roxb.). — A shipment of this boxwood recently examined, contained two different kinds of wood, one type which apparently does not split in the log or when cut up, or after manufacture, and the other which is liable to split under all these conditions. The great value of the first type is evident.

It should be noted that neither the Indian boxwood nor the West Indian sp. *Tecoma pentaphylla* Juss come under the genus *Buxus*.

7) Haldu (*Adina cordifolia* Hook) — in India, Burma and Ceylon — noted for the remarkable quality of the grain, smooth texture, durability and attractive colour, is worked very easily and does not split; it is also readily adaptable for chair making, carving, brush work etc. — and for shuttles and bobbins.

8) Koko (= East Indian Walnut) (*Albizzia Lebbek* Gamble) — re-

markable for its handsome colouring and good shape ; its durability is excelent.

9) Pynima (*Lagerstroemia Flos-Reginae* Retz) — a magnificent timber hitherto almost entirely overlooked, but probably a more valuable wood in its general qualities than any timber, for example, in the whole of North America. In India it is not as valuable as teak, as it is only partially resistant to attacks of white ant., in Europe however the author considers it ranks almost as high as teak. Its great reliability, coupled with excellent qualities of texture and grain, places it on a very high level for decorative wood work.

10) White Bombwe (*Terminalia procera* Roxb) — a very strong wood with firm, hard and close texture. Although there appears to be scarcely any actual demand in India, it should not be assumed that it cannot be utilised advantageously elsewhere. It should be borne in mind that the chief factor which determines the use of wood in India is its resistance to white ants, dry rot etc — points which are not of importance in other countries.

11) White Mahogany ("Prima Vera"). Source unknown (native of Central America) — a wood possessing a smooth, silky surface and very easily worked ; light weight but strong enough for fittings, fixtures in cabinet making, joinery and ship-building.

Attention is drawn also to the coral wood ("bois de corail") of the Andaman Islands, sissoo (*Dalbergia Sissoo*) which has been successfully used for fine cabinet work, and thitka (*Pentace burmanica*) which resembles Cuba mahogany.

M. L. Y.

443 - **Determination of the Value and Uses of the Various Timber and other Forest Products in British North-Borneo** (1). — SMITH, MIDDLETON, in *The Engineer*, Vol. CXXXII, No. 3444, pp. 710-711. London Dec. 30, 1921

There seems to be a continuous demand for Borneo Timbers and it was decided to make a series of tests to discover the properties and values of various samples hitherto insufficiently known outside Borneo, in order to satisfy the demand more adequately. There can be located within this belt, a number of blocks of 50 000 acres on which the stand of marketable timber will average 2 000 cub. ft. or more per acre. Estimates based on 169 342 acres on the East Coast show the average stand to be 2613 cub. ft. per acre, the two species occupying the greater part of the stand being the "Seriah" or Borneo cedar (*Hopea* sp.) which is the most abundant timber of North Borneo, and the "kruen" or "apitong" (*Dipterocarpus grandiflorus* Blanco) a timber suitable for constructional work, and suggested as useful for gun-stocks.

From the results obtained from the tests it was found that all the samples were more resistant to bending than crushing. The following were classed as hard woods and their average coefficient of bending strength was determined as follows :

(1) See *R.* April 1919, No. 476. (Ed.)

"Selangan batu" 8.06; billian (Borneo iron wood) (1) 7.29; "mirahow" (2) 6.77.

The following were classed as soft woods:— "greeting" 4.92; camphor wood (3) 4.93; oba sulu 4.92; orat mata 4.57; krueu 4.45 (4); kacha 4.24 and red serayah (5) 3.54.

A number of preliminary tests were made on samples of local woods in order to determine the most satisfactory method of loading and the best method of measuring deflections.

As a result of the tests for uniformity, the selangan batti was found the most uniform and after this the "oba sulu" and red "serayah". The crushing strength of each was within 10% the mean value.

The results of the bending and compression tests on samples submitted by the China Borneo Company are given in tabular form

## ■ LIVE STOCK AND BREEDING

### HYGIENE

444 - **Studies on Foot and Mouth Disease in France** (2). — I SCHEIN, Dualité possible de la fièvre aphteuse, in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 3, pp. 204-206. Paris, January 16, 1922. — II VALLÉE H. and CARRÉ A., Sur l'immunité anti-aphteuse *Ibidem*, pp. 207-208.

I. — As a working hypothesis, SCHEIN suggests that the name of foot-and-mouth disease has been given to two quite different maladies. Both are self-immunising, but neither are reciprocally immunising. True foot-and-mouth disease (aphthic fever), would appear to be contagious to man and pigs, or to one or other only, whereas "aphthoid fever" (the other disease), cannot be contracted by human beings or swine, or any other animal that is not subject to aphthic fever.

II. — VALLÉE and CARRÉ give reasons to explain the instability of anti-aphthic immunisation and also raise the question of the plurality of aphthic viruses. F. D.

445 - ***Solenopotes capillatus*, a Sucking Louse in Cattle, hitherto unknown in the United States.** — BISHOPP F. C. (Entomologist, Investigations of Insects affecting the Health of Animals, Bureau of Entomology, U. S. Department of Agriculture), in *Journal of Agricultural Research* Vol. XXI, No. 11, pp. 797-801, figs. 6 Washington, September 1921.

*Solenopotes capillatus* n. g. and n. sp. was described in 1904 by ENDERLEIN; this parasite was found on cattle in Leipzig. The author has discovered that the species has a wide distribution in the United States. He describes its life-cycle and states that, unless the measures necessary for its control are taken, it will become a serious cattle pest. F. D.

(1) *Eusideroxylon Zwageri* Tand B., (2) *Intsia Bakeri* Prain and *Alzelia palembanica*; (3) *Dryobalanops aromatica* Gaert; (4) *Dipterocarpus grandiflorus* Blanc; (5) *Hopea* sp. or *Shorea leprosula* Mq. (See *Timbers of the World* by A. L. HOWARD p. 425, Macmillan Co., London).

(2) See *R. Mar.* 1922, No. 278. (Fd.)



446 — **Diseases and Parasites of Sheep in Syria.** — See No. 457 of this Review.

447 — **Stomoxes as Carriers of Dromedary Trypanosomiasis.** — SERGENT, E. and DONATIEN, A., in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 8, pp. 581-583. Paris, February 20, 1922.

The authors, as a result of observations and experimental researches, have come to the conclusion that dromedary trypanosomiasis is naturally transmitted in two ways: 1) in the open country, in the wheat fields by gadflies, for the larvae of these insects swarm in the damp sand of the valley bottoms; 2) in inhabited places (caravansaries), by stomoxes, for the straw litter in the stables harbours many of these pests. (The authors have found stomoxes in all the regions of North Africa, the coast, high-plateaux and the Sahara).

The trypanosomes do not develop within the insects, but are merely mechanically transported by them acting as carriers conveying the micro-organisms lancetwise on the exterior of their proboscis.

For the spread of the infection it is necessary that the insects should sting an animal suffering from trypanosomiasis in such a manner that the puncture bleeds, and then immediately sting a healthy individual. As trypanosomiasis is a disease of long duration in the dromedary, this animal acts as a reservoir of virus.

F. D.

448 — **Experimental Researches on the Effects of Castration.** — LEINATI, L. (Istituto di Patologia comparata della R. Scuola Superiore di Medicina Veterinaria di Milano), in *La Clinica veterinaria*, vol. XLIV, No. 21-22, pp. 635-647 bibliography of 18 works, Milan, November 15 and 30, 1921; Vol. XLV, No. 1, pp. 14-30, bibliography of 48 works, January 1922.

ANATOMY AND  
PHYSIOLOGY

I. — **LEUCOCYTIC PHAGOCYTOSIS IN CASTRATED ANIMALS.** — The author gives a brief sketch of some of the most important researches made on this subject, before proceeding to a detailed account of his own experiments (on adult dogs) the results of which lead him to conclude that castration causes a decrease in the phagocytic index of the leucocytes. This effect is the same whether both or only one testicle is removed; in the former case, however, it is less marked and tends to disappear after a certain time, whereas in the second it persists without any change for 80 days after the operation.

The endoperitoneal inoculation of testicle extract into animals from which both testicles have been removed at once causes a rise in the value of the phagocytic index, but this does not last long and 24 hours later it falls to its previous level.

II. — **HAEMATOLOGICAL OBSERVATIONS ON CASTRATED ANIMALS.** — This article gives a rapid review of the many works dealing with the effects produced on metabolism, the tissues, the functional correlations of the genital and other glands, the active protective mechanism against disease (phagocytosis, serological reactions etc.), and also describes the author's own observations as to the red and white corpuscles, both from the quantitative standpoint (absolute and relative estimate of the number of these bodies), and from the qualitative (morphology and structure of the corp-

uscles). The animals used in the experiments were dogs. The results obtained lead to the following conclusions:

1) Castration has no appreciable effect, either quantitative or qualitative, upon the red blood corpuscles, nor upon the total number of the white corpuscles. This applies equally to monolateral and to bilateral castration.

2) The castration of adult animals produces on the other hand very noticeable and durable changes in the relative quantity and ratio, of both kinds of corpuscles, and causes:

a) a considerable decrease in the lymphocytes; b) a certain diminution in the number of acidophilous, polynuclear leucocytes; c) an increase in the large, mononuclear leucocytes; d) a certain increase in the basophilous, polynuclear leucocytes; e) a very noticeable increase in the neutrophilous, polynuclear leucocytes.

3) The effect of castration upon the relative number of leucocytes is more evident in the case of bilateral than of monolateral castration. The results, which manifest themselves very quickly, have a certain tendency to become permanent. F. D.

449 - **The Possibility of Castrating Animals by the Use of Serums.** — GIULIANI, R. (R. Scuola Superiore di Agricoltura, Portici), in *Giornale di Agricoltura [della Domenica]*, Vol. XXXI, No. 30, p. 306. Plaisance, September 25, 1921.

The author has studied the possibility of substituting "biological" for surgical castration effected by the application of the principle forming the basis of cytolytic serums. The laboratory experiments hitherto carried out have given encouraging results. These experiments were directed to the preparation of a rabbit orcholytic serum. A he-goat was used to supply the serum; periodic injections of the solution of nucleoprotein, from the testicle of the rabbit being made in constantly increasing doses. The serum thus obtained was injected into rabbits; 3 to 4 cm. were injected each time at intervals of 8 to 5 days. 15 days after the first treatment, the testicles were already perceptibly atrophied, and the seminiferous ducts, although still recognisable, contained a kind of granular detritus. By prolonging the action of the serum for 30-40 days, a progressive atrophy (of the testicle glands was produced; these were to a large extent empty, and consisted of albuginea, interstitial connective tissue and a little much modified parenchymatous matter, in which the seminiferous ducts could with difficulty be distinguished. F. D.

450 - **The Rejuvenescence of Animals; Experiments on Old Fowls and Doe-Rabbits.** — CHARON, A. G., OINENÉ, G., and YONENO, G., in *Journal d'Agriculture pratique*, vol. 55, Part. II, No. 48, pp. 454-457, figs. 4. Paris, December 3, 1921.

CHARON in his paper recalls: 1) the discovery of BROWN-SÉQUARD (1869), that all the glands, whether provided with secreting canals or not, supply to the blood certain useful principles, and that when the glands become less active in consequence of accident, disease or old age, the absence of these products makes itself at once felt; 2) his experiments in rejuvenating old persons (increasing their muscular force, cerebral exer-

tion and general vigour) by means of the injection of the testicular fluid of rabbits, or guinea-pigs.; 3) the opotherapeutic measures based on the knowledge thus acquired — 4) the experiments of WORONOFF (Directeur de la Station expérimentale du Collège de France), on the rejuvenescence of animals by grafting pieces of testicle taken from still younger animals. Stress is also laid on the value of the application of these methods to farm-stock, if they were easy of execution, and the author publishes a communication sent to him for insertion in the *Journal d'Agriculture pratique* by Yasusi OINONÉ (Director of the Oinoné Institute of Agricultural and Biological Research at Ogawa, Japan), and YONENO (Aviculturist of the Oinoné Institute).

These authors mention the rejuvenescence methods devised by STEINACH (*Archiv für Entwicklungssmechanik*, vol. XLVI, 1920), and by SASAKI (of the Faculty of Medicine in the University at Kyusin). The methods suggested by STEINACH consists of the removal or ligature of the vasa deferentia, and that of SASAKI in administering, through the mouth an extract of the thyroid gland. They afterwards describe their own experiments, carried out according to the SASAKI method on old fowls and doe-rabbits. White Leghorn fowls of 6 years of age were given fasting, once daily at 6 in the morning, 0.03 gm. of dry extract of thyroid gland. The results were entirely satisfactory, as is shown by Table I. One of the birds which had only laid 25 eggs in 1915-1919, laid 129 in 1921-1922. The hens thus treated also became youthful in appearance; their skin grew fine and soft, their combs delicate and bright red and their movements were full of vigour.

TABLE I. — *Rejuvenescence experiments*  
with fowls of six years of age, March 31, 1920.

Length of treatment	Number of eggs laid	
	From Sept. 1 1918 to Aug. 31 1919	From Sept. 25 1920 to Sept. 24 1921
	without treatment	With treatment
15 days . . . . .	22	68
15 days . . . . .	28	50
30 days . . . . .	24	99
30 days . . . . .	29	103
40 days . . . . .	25	129
40 days . . . . .	26	105

Excellent results were also obtained with the doe-rabbits (Belgian breed); the data are given in Table II. Their appetite increased, they regained a youthful appearance, their fur became thicker, and they showed symptoms of heat and all but one (No. 2), were fertilised.

CHARON draws attention to the fact that it is quite conceivable that the thyroid extract, by exciting the reproductive functions, would stimu-

TABLE II. — *Experiments in the rejuvenescence  
7-year-old Doe-Rabbits, in 1919.*

No.	Duration of treatment	No. of young in litter produced after treatment	Appearance of animal after treatment
1. . . .	10 days	3	Slightly younger looking. Little vivacity
2. . . .	10 days	0	Rejuvenated; very lively
3. . . .	25 days	7	Much rejuvenated; very lively
4. . . .	25 days	5	Much rejuvenated; very lively

late egg production in fowls that are fairly good layers. The treatment can be carried out by giving in the morning, thyroid gland, or iodo-thyrine, mixed in suitable doses with a light paste. F. D.

## HORSES

451 — **Horse-Breeding in Czecho-Slovakia.** — *Bulletin of the Ministry of Agriculture of the Republic of Czecho-Slovakia, Year II, No. 3, pp. 23-24. Prague, 1921.*

The breeding of horses for agricultural purposes is organised by the Ministry of Agriculture. The Military Authorities also have Stud Stations for breeding Army horses. The horse-breeding establishments are (except in rare cases), military institutions, and under the management of Stud Officers, or of army veterinaries. The Staff is composed of soldiers and civilians, except at Kladruby, where the Stud Station (the former Stud Station of the Emperor of Austria), is entirely managed by civilians.

In Bohemia, the horse-breeding Stations are at Domazlice, Nemošice and Písek. In these establishments stallions for use in the country only are bred, but at Nové Dvory, there is a State Horse Rearing Station where the young stallions bought from horse-breeding farmers are reared to supply the State Stud Station. At Kladruby, there is a similar establishment which is better suited to the purpose, as mares are also available whose foals have been weaned. In Moravia, the State Stud Stations are at Hodonín and Zlín — in Silesia, at Opava — in Slovakia, at Nitra, and Prešov — and in Sub-Carpathian Russia, at Turg-Kemety. Another Stud Station has recently been established in Slovakia.

In Bohemia and Moravia spirited, more robust horses of the oriental type or pure-bred English horses are bred for improving the blood. In the Czech countries farmers prefer the Ardennes or Noric breeds; in Slovakia, the oriental or the Noric, horse is the favourite. In Pre-War times, the interests of the army ranked before the farmers' with the result that the requirements of agriculture have not been satisfied.

In Sub-Carpathian Russia in the mountainous districts small robust "hucul" horses of a Polish breed are the best suited, and most in demand, for agricultural purposes.

In the Republic of Czecho-Slovakia, horse-breeding is organised in such a manner that the countries are divided into two districts. In the first, light mettlesome horses only may be reared, and in the second, only the heavier breeds. The zones are determined after some years have elapsed, according to the number of mares belonging respectively to light or heavy breeds to be found, as reported by the Commission under the control of the Ministry of Agriculture.

The Chambers of Agriculture, in conjunction with the Ministry of Agriculture of the former Monarchy, have supervised horse-breeding and collaborated with the Stud Stations for the disposal of stallions that are unsuitable for sires, in making Service Stations in the different districts, supplying stallions for private breeders, etc.

The service season for the mares lasts from February 1 to June 30. The Service fee is 200 crowns. In Bohemia, there are 130, in Moravia 80, in Silesia 30, and in Slovakia 120 special Stations with from 1 to 10 stallions at the disposal of horse-breeders, the State paying the rent. In addition there are private Stations which are only kept open in the same place for 4 years for the 2 types of breed.

The number of State stallions is estimated at 600 in Bohemia (half being of each type), 450 (in the same proportion) in Moravia and Silesia, 420 in Slovakia (where almost all are of the lighter type), and at 60 (light-type) in Sub-Carpathian Russia, that is to say the State possesses altogether 1510 stallions.

There are only about 240 stallions belonging to private individuals. These animals must have a Government Service Licence according to the decree of 1874 in Bohemia and to the law of the country (1905), in Moravia. A new law is being framed to establish other horse-breeding districts.

The most famous private Stud Stations are those of Baltazzi (Napajedla), Sailern (or Lukov, in Moravia where Belgian and English breeds are reared), Schwarzenberg (or Hluboká; English pure bloodstock), Baur (Pohled), Kinsky (Lysá n. L.), etc.

In Bohemia and Moravia, there are Unions and Cooperative Societies for breeding heavy blood animals or horses of the Noric breed. The Czechs prefer the Belgian and the Noric breeds. The Czech cooperative Societies are very prosperous and are able to buy and import foreign horses without any grant from the State. The Unions of the native breeders are at Sv. Dvory, Breznice, Pardubice, Benesov (light type), Caslav, Opocno, Prepychy, Belohrad, Budejovice, Netolice (heavy breeds) etc. In Moravia, the Horse Breeders' Union includes 38 Czech Societies (20 for the breeding of light and 9 for the breeding of heavy horses), and 7 German Societies; 4000 mares are registered on the Stud-Books.

The chief horse-markets are at Budejovice, Benesov, Netolice, Chrudim, Usti n. L. Horse-races are held at Prague, Bratislava, Pardubice and Karlovy Vary.

In pre-war Austria in 1866 the direction of horse-rearing passed from the control of the Ministry of War to the control of the Ministry of

Agriculture, but the Stud Staff still remained military. Any special questions were referred to the Ministry of Agriculture, but the staff was under the Ministry of War. The reason of this divided authority was financial. The valuable animals reserved for breeding-purposes could only be entrusted to reliable persons, i. e. to disciplined soldiers. Since however the Stud Stations were under the authority of the Ministry of Agriculture, the interests of agriculture received special consideration. This Ministry could always rely upon obtaining the collaboration of the horse-breeding farmers, and allowed them consultative powers as regards questions related to horse-breeding through the medium of the local commissions appointed in all the Provinces.

*Provisional statistics of the number of horses*

	in Bohemia	in Moravia	in Silesia
Dec. 31, 1910	250 428	140 970	31 769
May 31, 1919	199 427	109 092	16 592
Dec. 31, 1919	221 652	128 816	25 866
In 1911 in all the Slovakian Comitats			274 502
In 1911 " " " "			42 793
In 1911 in Slovakia, and Subcarpathian Russia			149 299

452 - **Study On Horse Breeding in the United States.** HARPER M. W. in *Cornell University Agricultural Experiment Station Bulletin* 403, 49 pp., figs. 17. Ithaca, New York, 1921.

The object of these researches which were begun in 1909 and continued for 10 years, was to obtain data on the breeding of foals, in order to prevent the losses due to failure of conception, or easily preventable diseases in the mare.

The observations which were made on 34 brood-mares, used chiefly for agricultural work, and to a small extent for hauling coal, lasted in the case of the mares from the time of service until weaning, and the foals, from birth until maturity was reached. The studies include the rations to be given to a foal, the amount of food required, the development attained, the cost of rearing.

The 34 brood-mares studied (Percherons, half-bred Percherons, pure bred Hackneys), produced as the result of 144 matings, 83 living foals counting one set of twins, 17 foals died shortly after birth. The gestation period varied between 316 and 361 days, the average being 333 days. The duration of the gestation period was on an average 4 days longer for colts than for fillies varying from 317 to 361 days (average 335), and from 316 to 357 days (average 331) respectively. In the case of 171 brood-mares under observation in addition to those forming the subject

of the experiment, the average length of the gestation period was 335 days and the difference in the case of the two sexes was scarcely one day.

The author has drawn up Tables relating to the winter-feeding (from October 9 to May 8), of 66 just weaned foals, 53 foals of over one year of age and 46 two-year-olds. The average consumption was in the first group, 551 kg. of grain + 724 kg. of hay, or 4.8 kg. of grain + 6.3 kg. of hay per kg. of increased live-weight; in the second, 684 kg. of grain + 1150 kg. of hay, or 8.7 of kg. grain + 14.6 kg. of hay; in the third, 862 kg. of grain + 1267 kg. of hay, or 25.6 kg. of grain + 37.7 kg. of hay.

The rations given were: for sucking foals, a little grain 3 times a day, beginning with 100 gm. and gradually increasing up to 450 gm.; for weaned foals, 680 to 910 gm. of grain 3 times a day, and in addition, 1 kg. to 1.8 kg. of hay in the morning and 1.8 kg. to 2.3 kg. in the evening; for foals over one year old 1.4 kg. of grain in the morning 0.9 kg. at midday, and the same amount in the evening, as well as 3.6 kg. to 4 kg. of hay morning and evening; for foals above 2 years of age, 1.4 kg. of grain 3 times a day and from 4 kg. to 4.5 kg. of hay morning and evening.

If it is assumed that a sucking foal consumes 82 kg. of grain, the total amount consumed by a foal from birth until 3 years of age is about 22 quintals of grain and 31 quintals of hay.

The average weight of 66 foals at birth was a little over 52 kg., the 33 colts weighing 52.7 kg. and the 33 fillies 52.2 kg. The average weight (geometrical average) of 67 foals on May of the year following their birth was 345 kg., the average increase in the mean weight was 291 kg., or 553 % in 377 days from birth.

The average weight of 53 foals on May 9 of the year when they completed their second year, was 494 kg. showing an increase of 153 kg. over their weight in the previous year, or 44 % (409 gm. per head and per day). The decreased rapidity of growth was still more marked in the following year, on May 9 of their third year, the foals weighed on an average 576 kg. or 76 kg. more than in the previous year i. e., 15 %. If the weight at birth is subtracted, it is found that the foals had gained 524 kg. in 3 years, 291 kg. having been put on during the first 377 days. This shows the importance of insuring the rapid growth of the animals from the beginning. The above-mentioned data are a further confirmation of the statement that growth during the early stages of a foal's life is not only more rapid but obtained with the consumption of less food.

The cost of rearing a foal up to the age of 3 years is estimated as follows.

The author gives a large number of general rules for the feeding and management of brood-mares and foals.

On a farm devoted to horse-breeding, it pays best, as a rule, to purchase food in more or less large quantities. On a general farm, all the food consumed by the horses should be grown on the premises.

On farms where general crops are cultivated, and the horses have much hard work to do at the harvest seasons and when important operations are in progress, but are little used the rest of the year, it pays well

to employ mares, since the foals they produce make up for the days lost during foaling etc.

	dollars
Service fee . . . . .	15.00
Days of work lost by the mare during service and foaling *, 10 at 1 dollar each . . . . .	10.00
Insurance and risks { Brood-mare 200 dollars 3 % risk Foal of less than 1 year 40 dollars 20 % risk Foal of more than 1 year 70 dollars 1.5 % risk Foal of over 2 year's 120 dollars 1.5 % risk }	16.85
Veterinary service and medicines . . . . .	2.00
Keep and stabling . . . . .	20.00
Food (grain and hay). . . . .	108.64
Pasture . . . . .	15.00
<b>Total . . . . .</b>	<b>187.49</b>
Credit for work done from the age of 2 1/2 years. . . . .	29.15
<b>Net cost of foal at the age of 3 years. . . . .</b>	<b>158.34</b>

\* The mares continue working to within a few days of foaling as this has been found beneficial both for dam and off-spring.

Given that the net cost of rearing a three-year-old foal may be reckoned, as appears from the above, at about 160 dollars, and that the animal will fetch 225 dollars, a profit of 50 dollars viz., 30 % on the capital employed will be obtained. F. D.

453 - **Essays on the Depreciation in the Selling Value of Injured Horses. Permanent Lameness.** — NICOLAS F., in *Recueil de Médecine vétérinaire*, Vol. XCVIII, No. 2, pp. 71-80, Paris, January 30, 1922.

The damages to be paid by third parties who are responsible for accidents come under two heads: *compensation for temporary inability to work*, if lameness disappears; *compensation for actual depreciation* (which must be paid in addition to the first), if the horse is permanently lamed: The author considers the question of assessing this latter liability for which there is at present no guide.

The consequences of lameness are of two kinds: 1) economic; 2) physical.

1) *Economic standpoint.* — The lamed animal has lost its usual capacity for work owing to diminished speed, or increased fatigue.

The kilogram output per second (D'') is the result of the product of the animal in kilogrammes (E) and the speed per second in metres (V). —  $D'' = E \times V$ . As there are no existing data whether of an empirical or experimental character for measuring the decrease in V due to lameness, the decrease in the output cannot be directly determined.

The author avoids the difficulty by first calculating the pecuniary loss involved in a determined incapacity for work and obtains the following formula:

$$\text{Pt. r.} = g \times n \times (14 - a) \times \frac{i}{100}$$



where  $Pl. r.$  = loss of return;

$g.$  = daily return from animal after subtracting expenses of keep.

$n$  = number of work-days per annum.

$a$  = age of animal at the time of the accident (14 —  $a$  can however never fall below unity if  $a$  is 14, or higher);

$i$  = incapacity for work expressed in centimes.

Two cases may occur: *a*) incapacity for work involving a loss of output greater than the maximum possible depreciation of the horse (it is evident that it is the maximum depreciation that must be paid in compensation); *b*) a loss of return lower than the maximum depreciation, in which case the actual loss alone must be made good.

The maximum depreciation (Dp. m.) that a horse can undergo is given by the formula (1):

$$Dp. m. = Vba - P \times p \times c$$

$Vba$  is, other things being equal, the value of the horse before the accident according to the age ready-reckoner;

$P$  = the weight of the horse;

$p$  = the price per kg. of meat of the horse as it stands;

$c$  = a coefficient that is 1, if the animal is only fit for the butcher, and above 1 if the horse has still some work in it before it is slaughtered. According to some statistics relating to rejected army horses, the author has taken  $c$  as  $= \frac{10}{8}$ . This coefficient is, however, liable to variation according to the season, place, etc., which require to be determined. (2)

In order to calculate the loss of output due to a given incapacity for work, it is necessary in the first place to determine what amount of incapacity for work is produced by different degrees of lameness. Three such degrees may be considered: *a*) severe lameness, or when the animal has to go on three legs, causing an incapacity of 50 to 100 %; *b*) slight lameness, scarcely perceptible, causing an incapacity of 1 to 5 %; *c*) unqualified lameness, which is the most common; this the author divides into 2 categories: acute lameness causing an incapacity for work ranging from 20 % to 50 %, nearly always entailing the maximum depreciation; slight lameness, 5 to 20, which generally causes partial depreciation.

2) *Physical standpoint.* — The importance of the horse's lameness depends upon the use made of the animal. In saddle or trotting horses, it entails the maximum depreciation.

Owing to the serious economic results of lameness, the expert should in practice consider carefully in the case of a recent accident likely to

(1) See R. Feb. 1922, No. 189. (Ed.)

(2) See: NICOLAS: Points de repère pour l'estimation de la valeur des chevaux de réforme de l'Armée. (Points to be taken into account in estimating rejected Army horses), in *Recueil de Médecine vétérinaire* No. 17 p. 299, Sept. 15, 1921 — The sale price of a rejected horse does not depend upon its age. It is about  $\frac{3}{8}$  of the purchase price at the same date. The chief factor regulating the sale price is the weight of the animal;  $\frac{3}{10}$  of the total value of the horse is represented by its worth to the butcher, and  $\frac{2}{10}$  by its value as a work-animal. It is easy to calculate the former as a function of the price per kg. of the meat, of the weight and return (on an average 50 %), and all that is required, in order to ascertain the market value of the animal, is to multiply the butcher's estimate by  $\frac{10}{8}$ . (Ed.)

cause permanent incapacity for work, whether it is worth while to undertake any treatment. To decide this point, a comparative estimate must be made of the value of the horse on the one hand, and the probable cost and possible depreciation on the other. This can be done by means of the following equation :

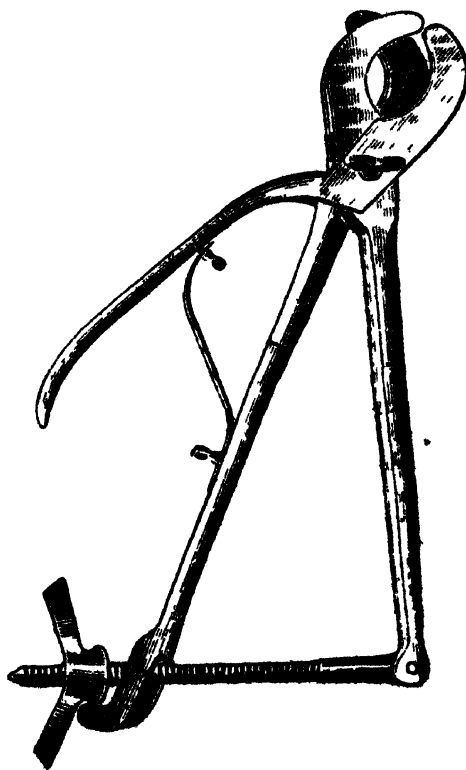
$$\frac{\text{Maximum depreciation}}{\text{damage} + \text{loss of output}} = x$$

If the proportion is below or equal to unity it is economically useless to treat the horse, and its slaughter should be recommended. In any case, treatment is expensive and may prove unsuccessful; there is considerable risk that the outlay involved in 2 or 3 months' medical care, feeding, and the hire of a substitute will be thrown away upon a depreciated horse.

F. D.

454 - **Lesbouyries' Pincers for Castrating Horses.** — LESBOUYRIES, in *Recueil de Médecine vétérinaire*, Vol. XCVIII, No 2, pp 53-44 fig 1 Paris, January 30, 1922

Castration by means of crushing the seminal cord is usually practised with an emasculator, or with REINER's pincers which have the advantage



LESBOUYRIES' Pincers.

age of affording great haemostatic security. The author, however, found that the grip of the crusher was not regular or always sufficient to insure haemostasis, and that after a certain number of operations, the knife deviated from the arm of the crusher, so that only an inadequate and unsatisfactory section was made. In order to remedy these defects, certain modifications were made in the pincers. The jaws are tightened by a rapidly-moving spring, instead of by a toothed-bar; the cutting-blade is made independent, by being mounted on a special screw; other minor alterations have also been made so that the instrument can be easily taken to pieces. The accompanying figure shows the instrument in its new form. F. D.

455 - **New Methods of Judging Cattle** (1). — I. KOPPE, Das ostfriesische und provinzial-sächsische Körverfahren; II. CORNELIUS, Das oldenburgische Körverfahren; III. Das Jeverländer Körverfahren; in *Deutsche landwirtschaftliche Tierzucht*, Year XXV, No. 17, pp. 170-171. Hanover, April 1921. — IV. GOWEN, J. W., Studies on Conformation in Relation to Milk-Producing Capacity in Cattle, in *Journal of Dairy Science*, Vol. IV, No. 5, pp. 350-374, Baltimore, September, 1921. — V. MARCQ J. (Institut agronomique de Gembloux) and MAHY M., Des modes d'appréciation du bétail dans les concours et du type idéal bovin à rechercher en Belgique, in *Annales de Médecine vétérinaire*, Year XLVI, Nos. 8-9, pp. 337-364. Ixelles-Brussels, August-September 1921. — VI COLOMBE M., Appréciation des qualités beurrières et laitières chez les vaches, in *Journal d'Agriculture pratique*, Year LXXXV, No. 44, pp. 377-379, and No. 45, pp. 391-393. Paris, November 1921.

X. — **CATTLE JUDGING AT SHOWS IN EAST FRISIA AND THE PROVINCE OF SAXONY (PRUSSIA)**. — Cattle entered at Shows in East Frisia are judged according to LYDTIN'S method. The judge scores for milk conformation, head and horns, coat, colour, conformation, capacity, general appearance: 3 points mean excellent, 2 good, 1 mediocre, 0 poor that is to say, rejected. For milk conformation and general appearance the points are doubled. The perfect animal thus receives 24 points to which are added points for measurements (18 in the case of a perfect animal), or 42 points altogether.

Three points at the maximum are given for the following first 3 measurements taken together, and 3 for each of the others:

height: a) at withers; b) at centre of back; c) at point of withers; d) at insertion of tail: e) length and width: f) of chest; g) of pelvis; h) of haunch; i) depth of chest:

b) should not be less than a;

c) should not be greater than  $a + 8$  cm;

d) should not exceed  $a + 6$  cm;

e) in cattle 3 years of age should at least be  $a + \frac{1}{10}a$ ; in the case of older animals, it ought to be  $a + \frac{3}{20}a$ ;

f) at least  $\frac{1}{3}$  of a.

g) at least  $\frac{1}{2}a$ .

(1) See R. April 1921, No. 411. (Ed.)

Should the width of the chest and pelvis and the length and depth of chest exceed by 5 cm. the required measure, the animal is classed as good, if they exceed them by 10 cm. the animal is classed as excellent.

This method, in which the number of points depends upon the opinion of the judge and upon measurements, has been in vogue until recently, but the number of entries at the shows has now increased to such an extent as to make it impossible to carry out the measurements. For this reason, the "Gesellschaft für Züchtungskunde" (German Stock-Breeding Society), has taken the initiative in introducing a new scale of points to be adopted throughout North Germany.

In the new method of scoring used by the "Verband für die Zucht des Schwarzbunten Tieflandrindes in der Prov. Sachsen" (Union for Breeding Black Pied Netherland Cattle in the province of Saxony), a maximum of 100 points is credited to the ideal animal, each part being estimated by points 1 to 5, as follows: 5 = excellent, 4 = good; 3 = fair; 2 = mediocre; 1 = poor, rejected. The scale of points is as follows:

1) General appearance	5 > 4 points
2) Head, horns and neck	5 < 2 "
3) Shoulders, chest	5 < 1 "
4) Back, flanks, loin, paunch	5 < 2 "
5) Pelvis, croup, hip, insertion of tail	5 < 3 "
6) Thurl	5 < 1 "
7) Limbs, gait	5 < 1 "
8) Colour, skin, and coat	5 < 1 "
9) Udders and milk ducts in the case of cows, genital organs in bulls	5 < 2 "
10) Development, vigour	5 < - "
11) Pedigree	5 > 1 "
<i>Total</i>	100 points

KOPPE proposes putting general appearance at the bottom of the scale so as to summarise the preceding points.

II — METHOD OF CATTLE-JUDGING ADOPTED IN OLDENBURG. — Since 1909, only the offspring of registered animals may be entered on the Oldenburg Herd-book and these are subjected to a very strict examination, especially in the case of bulls. There is a supplementary register ("Hilfsbuch") for good cows born of unregistered parents, the female (but not the male) offspring of the cows entered on this register, if sired by a registered bull, may be entered after examination on the Herd-book. Registered bulls only are allowed by law to serve cows not belonging to the owners. The accompanying form is used in judging bulls (Table I).

This form is a modification of the one proposed by MÜLLER for the cattle of Jeverland.

TABLE I. — *Form used in Oldenburg in judging bulls.*

Name . . . . .  
 Date of calving . . . . .  
 Breeder . . . . .  
 Owner . . . . .  
 Date of examination . . . . . Place where examination took place . .

	Points	Remarks
1) Back line and position of tail . . . . .		
2) Length . . . . .		
3) Depth of chest, abdomen . . . . .		
4) Shoulders and width of flanks . . . . .		
5) Hips and pelvis . . . . .		
6) Thurls and hocks . . . . .		
7) Width of chest, position of shoulders and neck . . . . .		
8) Neck, head and horns . . . . .		
9) Skin and coat . . . . .		
10) Colour . . . . .		
11) Strength, shape and position of limbs . . . . .		
12) Gait . . . . .		
13) Vigour . . . . .		
14) Pedigree . . . . .		
15) Udders and signs of capacity for milk-production . . . . .		
16) General appearance . . . . .		

Points 5 = excellent, 4 = good; 3 = fair; 2 = mediocre; 1 = poor; 0 = very poor

Maximum of points = 90; minimum for acceptance, 54. For evidence of capacity for milk production, and for general appearance, double points are given

III. — METHOD OF CATTLE JUDGING ADOPTED IN JEVERLAND. — In the territory of the "Jeverlandische Herdbuchverein" (Union of Pedigree Cattle Breeders in Jeverland), bulls entered have been judged since 1861 in accordance with a law passed that year. Until 1901, the animals were judged only by the eye without any measurements.

Dating from 1893, many investigations have been carried out by means of measurements made with LYDTIN'S apparatus. The data obtained served to determine the normal development of the animals at different ages, and were taken by MÜLLER as the basis of his cattle-judging method which has been adopted in Jeverland since 1901. According to this method, 15 notes each of 3 points can be given for each animal viz.: 0: bad; 1 fair; 2 good; 3 excellent. The third note (general appearance) may have double marks, so that the points for the perfect animal will be 48. For admission to the herd book, an animal must obtain at least 28 points. If 2 out of the 3 judges see at a glance that an animal cannot be admitted, no measurements are taken and it is withdrawn. The points based on measurements are 5 in number: back line, length, width of pelvis at hip, width of chest, depth of chest. In each case the minimum dimensions admissible are fixed for the different ages of the cattle.

TABLE II. — *Form Adopted*  
by the "Deutsche Landwirtschafts Gesellschaft".

	Maximum Number of points	Points credited by each judge	Average number of points	Remarks
I	2	3	4	5
I. <i>Breed value:</i>				
1) Breed, colour, pedigree . . . . .	10			
2) Vigour . . . . .	10			
3) Health, strength . . . . .	10			
II <i>Body:</i>				
1) Head and neck . . . . .	5			
2) Trunk . . . . .	10			
3) Limbs, gait . . . . .	5			
4) Skin and coat . . . . .	5			
III. <i>Productive value</i> *	30			
1) Signs of capacity for milk production	—			
2) Signs of capacity for beef production	—			
3) Signs of capacity for work	—			
IV. <i>General appearance</i> . . . . .	—			
<i>Total</i> . . . . .	100			

\* In scoring for milk, beef and work in the case of different breeds, the market values must be taken into account

Since 1914, additional points are credited separately to cows for butter production viz.: for an annual yield of 100 kg. of butter, 1 point; for 125 kg and over, 2 points; for 150 kg and over, 3 points. Cows of less than 5 years of age received an allowance of 5 kg of butter. The production of the last year of testing or the average of the last two years is taken into account.

IV — STUDIES ON CONFORMATION IN RELATION TO MILK PRODUCING CAPACITY IN CATTLE (1). — Taking as his basis a large series of data collected by the American Jersey Cattle Club on the scores of cows inscribed in the Registry of merit, GOWEN has compiled a table giving the mean score and milk yield as scored by 19 different judges and also the mean annual milk yield of these groups of cows. In a second Table, he gives the standard deviation for the two average groups and in a third, the correlation between the score and the milk yield as shown by 19 different judges. The average correlation coefficient is 0.246. It is negative in 2 cases, and positive in all the others (leaving out the negative cases), from  $0.027 \pm 0.104$  to  $0.614 \pm 0.067$ .

These figures show the great influence of the personal equation of the cattle judge. Cows giving approximately the same milk yield have a difference of  $6.5 \pm 0.6$  points on score according to the decisions of two individual experts. No particular association is shown to exist

(1) See R. Oct. 1920, No. 1012 (Ed.)

between the variation of each judge in his total score and the variation of the cattle he judged as to their milk yield; there is on the contrary, a certain parallelism between the scores of several judges for different groups of cattle.

The judges differ not only in the mental scale by which they make their judgements, but also in their capacity for correct classification as regards milk yield and butter-fat percentage. Of the 19 judges considered in this paper, 9 were good, 8 mediocre and 2 inefficient, as giving better scores to low-producing cows than to high producers, and responsible for the two above-mentioned negative correlations. The average ability of this group of judges to score for milk yield is about 25 %, better than that of the average trained dairyman.

There is no relation between the average score given by each judge to his group of cows and his ability to value them for milk production. When it is noted that the mental scale of each judge differs considerably this fact is significant. It shows clearly why two equally good judges of cattle may place their cows several points apart, while at the same time, they keep the cows in the relative order of milk yield.

Cows whose average milk yields are larger or variable are more easily judged than those with a lower or uniform milk production. The scores of good judges show more variation than those of inferior judges.

Only about one man in two can pick out a good milker at sight. It is therefore necessary for a judge not to rely entirely upon his ability to select cattle by conformation, but to test the actual milk yield by weighing the milk. Even if the milk production of one week only is tested, the figures obtained are nearly twice as valuable as an indicator of milk production over a long period as a judgement based on the conformation of the cow, although this conformation be judged by men of considerable ability.

V. — JUDGING CATTLE AT SHOWS. THE IDEAL TYPE OF CATTLE FOR BELGIUM. — The new method of judging cattle by points, instead of by general appearance, has not given the results expected in Belgium.

Seeing the great importance that the points method may have for the progress of cattle-breeding on Belgium, MARCQ and MAHY have made a study of its adaptation to judging Belgian breeds and consider; a) the systematic use of a scale of points; b) classification into categories; c) the publication of the points of the classification with a view to the professional education of the breeder; d) the use of measurements at Shows; e) the ideal type of cattle for Belgium.

a) Animals which have already been subjected to two preliminary tests should alone be admitted to examination. The first of these tests eliminates all cattle that are not entered in the Herdbook, or (in the case of cows) are not provided with a milk production certificate, and of which the body-measurements (such as height, circumference of chest), do not correspond with those of the type (to be determined according to the agricultural district); the second excludes all animals which are not of the required type; are unsuitable for breeding purposes.

es; are too fat, or show any defect in conformation that should be eliminated from the breed.

The authors advise: a jury of 3; a percentage-card with the marks: 10 perfect; 9 very good; 8, 7, 6 good; 5 tolerably good; 4 fair; 3, 2, 1 mediocre; 0 poor; the use of the simplest forms owing to the lack of uniformity in the Belgian breeds. On the strength of their personal experience they suggest the form reproduced in Table III.

TABLE III. — *Form used in Belgium.*

Judge No . . . . .		. . . . .		
Bull No . . . . .		. . . . .		
Maximum		Coefficients	Number of points	Products
			Out of 10	
40	Required type conformation capacity and weight . . . . .	4		
10	Line of back . . . . .	1		
20	Pelvis and buttocks . . . . .	2		
10	Chest (girth and flanks . . . . .	1		
20	Limbs (including shoulders, equilibrium gait . . . . .	2		
Total obtained out of 100				
To be subtracted from excess of fat (from 1-10) . . .				
Accredited total out of 100				

The form for the cows differs from that used for bulls, in as much as 10 points are added to the 3rd and 5th note, and 20 to a 6th: udder and teats.

Another model form gives a summary of the decision of the 3 judges and is the final opinion. It is not at present possible to credit cows with points for pedigree and tests of milk production. High points are given for the required type, this being necessary in the case of breeds with irregular variations.

b) In classing cattle, the number of prizes and of animals to be placed in each category should not be settled beforehand, for both should depend upon the number of good cattle entered. The total sum of the prize-money can, however, be fixed in advance, and also the number of classes and the proportion between the value of the prizes offered for each class: for instance the 1st prize may be four times, and the 2nd twice as much as the 3rd.

In order to draw attention to the type of animal desired, it is well to give one or more diplomas of honour to exceptional animals in the 1st Class.



d) The best type cannot be determined solely by means of body-measurements, which are, however, very helpful to the judges in forming an opinion of the conformation of the animals. As a model of a form based on measurements, the author reproduces the one adopted in Switzerland, where long experience has made it possible to determine fairly approximately the ideal measurements.

**Age of the animal examined**

cm.	%	Good measurements		Part measured	Maximum points	Points scored
		3 years old and over	1-3 years old			
		43-46	41-44.5	Chest: height . . . . .		
		43-46	43-45.5	" depth . . . . .		
		30-33	28.5-32	" width . . . . .		
		32-35	32-35	Length of pelvis . . . . .		
		31-34	30-32.5	Width of hips . . . . .		
		30-32.5	30-33	Coxo-femoral width . . . . .		
				Etc. . . . .		
				. . . . .		
				. . . . .		
				. . . . .		

(1) body-length 100.

As an example of model Shows that have proved the fallacy of the idea, very commonly met with among breeders, that conformation and a high milk yield are antagonistic, the authors mention those held in the Department of Seine-Intérieure (France) (1).

The author brings out the necessity for determining the ideal type of cattle for Belgium; he discusses the required characteristics which should be: good conformation, great capacity for milk and butter-production, fairly early maturity.

(1) See R. Dec. 1921, No. 1256. (Ed.)

by regions, the average measurements of the animals being compared with those of the standard type.

It is thus possible to compare the measurements of the cattle of the different agricultural regions, and by this means, to deduce their characters, as has already been done for Flanders by Prof. ZWAENEPOEL, *Annales de Médecine vétérinaire*, 1914. In this way, the authors have discovered that the Condroz cattle have a longer croup than the Herve cattle.

When the best average weight of an adult animal in good condition has been determined for a given region, the most economically satisfactory chest circumference to be taken as a type is that expressed by CREVAT's formula :  $P = 80 C^3$ , where P is the weight and C the circumference of the chest.

VI. — JUDGING COWS FOR MILK AND BUTTER PRODUCTION. — In October 1920, the Municipality of Lisieux (Department of Calvados, Normandy), opened a competition for milch cows. The first day the competing animals (46) were examined as regards their conformation by 3 judges who used percentage forms; in the evening, the cows were thoroughly milked; the next day the milk from each of the 3 milkings of the day was weighed and analysed according to GERBER's method.

COLOMBE compares and discusses the results thus obtained and shows that there is not sufficient parallelism between the number of points accredited to the cows and their actual milk and butter yields. On the whole, however, the highest points were given to cows which gave the largest amounts of milk on the following day, and no poor milker was scored high, or *vice versa*; the same cannot however be said for the butter production.

These results prove that no conclusion as to butter-producing capacity can be obtained from external appearance or empirical characters.

The author therefore proposes that the examination of cows at shows should be divided into two different parts, and entrusted to two sets of judges, the first part consisting of an examination of the general conformation of the animal, the results being entered on a simple form, whereas in the second, the characters of production which it is desired to improve should be considered and expressed by points multiplied by a coefficient and entered on the preceding form in order that they may be included in the total number of points awarded. F. D.

456 - **Wintering and Summer Fattening of Cattle in North Carolina, United States.** — FARLEY, F. W., and PEDEN, P. T. (Animal Husbandry Division, Bureau of Animal Industry) and CURTIS, R. S. (North Carolina Experiment Station), in *United States Department of Agriculture, Bulletin No. 954*, 18 plates, figs. 5. Washington 1921.

In the autumn of 1913, the Bureau of Animal Industry of the Department of Agriculture of the United States, in collaboration with the Agricultural Experiment Station of North Carolina, began a series of experiments in feeding beef cattle in the county of Haywood (North Carolina), which is the western part of the State and where most of the cattle reared are destined for beef production.

The work lasted for 6 years, and the results of the experiments of the first 3 years have already been published (1); those of the 3 last years form the subject of the Bulletin analysed.

In each group of experiments there were 17 to 40 calves of over a year old. The average duration of the winter feeding was 126 days beginning from December 12; the period of summer grazing lasted on an average 140 days. The lots fed mixed hay throughout the winter received on an average during the 3 years, 5 kg. of hay per head and per day; they lost 22.7 kg. of live-weight during wintering and gained 130 kg. during the whole course of the experiment, viz, in 266 days.

The lots fed all the winter on the ration of 12.25 kg. of maize silage per head and per day lost 18 kg. of live weight during the winter, and gained 134 kg. during the whole period of the experiment.

The lots that were fed throughout the winter on maize silage + maize stover + hay, consumed 6.9 kg. of the maize silage + and 2.8 kg. of the maize stalks and hay per head and per day. They lost 35 kg. of their weight during the winter, but increased 119 kg. in the whole period of the experiment.

The lots that grazed during the winter on detorested land and received a little mixed hay or maize stalks and straw during the short time the ground was covered with snow, lost 13 kg. of weight during the winter and gained 138 kg. during the whole experiment.

The lot fed all the winter (for one year only), on maize stalks + hay + straw, consumed 4.5 kg per head and per day during the winter; during this period they lost 29 kg of live weight and gained 128 kg. during the whole time the experiment lasted.

It was found that the cost of the food and the increase in live weight were on an average about the same, whether the cattle were fed throughout the winter on maize silage, or mixed hay. The ration maize silage + maize stalks + hay was much less expensive than mixed hay and maize silage alone. Winter grazing was the most satisfactory method of feeding, both on account of its cheapness and the increase of live weight obtained in the year. The authors also give rules for laying down meadows to be used as winter pasture.

The general average cost of feeding for the 4 winter months was about half the feeding cost for the whole year.

The mean cost per quintal of increase in live weight in the case of all the animals used in the experiment was 30 % higher in spring than in autumn. In the spring, the average loss of live weight was 6.5 %, calculating from their weight in the preceding autumn.

457 - **Sheep-Breeding in Syria and Cilicia.** *Haut Commissariat de la République française en Syrie et au Liban. Notes sur l'élevage du mouton en Syrie et en Cilicie*, 55 pp., 3 appendices. Beyrouth, November 1921.

These notes have been compiled by E. ACHARD, Head of the Agricultural service of the High Commissariat from information collected by

(1) In *Bulletin* No. 628, U. S. Department of Agriculture, summarised in *R* Feb 1919, No. 227. (Ed)

himself and from documentary evidence supplied by General MARTY for Cilicia, PAVIE and DJERRAHIAN for the Government of Aleppo, Com<sup>t</sup> Le BOULANGER, Com<sup>t</sup> DEVAUX, and H. RAMIZ MAKHZUMI for the Government of Damascus, Capt. MIEG, BRAIDY, ARSLAN, and NOUR for the Government of Great Lebanon, Col. NIEGER for the Territory of the Alaouites, CAYLA for the Sandjak of Alexandrette, and DUMONT the Chef d'escadrons for the sandjak of Djebel Bereket.

Syrian livestock consists chiefly of sheep, goats although much fewer in number coming next.

Syrian sheep belong to different varieties of the Asiatic breed (*Ovis aries asiatica*). They have the characteristic masses of fat on either side of the tail (fat-tailed sheep).

In some regions e. g. Turkestan, these masses of fat attain the weight of 16 kg. In Syria however they never appear to exceed 6 kg.

These accumulations of fat, which are no doubt a reserve stock, may disappear if the animals are reared for several generations on fertile land e. g. the civirdjik variety in Anatolia and the arab in Algeria.

The fleeces of the lambs of certain breeds supply a fur comparable to Astrakan (Karacul)

VARIETIES. — The most widely distributed variety is the "awass" which is the name of a nomad tribe of the Euphrates by which it is bred. These sheep are met with in Mesopotamia, Syria and Lebanon, where they are kept by the nomads. There are two sub-varieties: the "awass baladi" and the "awass deiry" of the region of Deir er Zor.

The height of the average "awass" sheep is 0.70 m. and its length varies from 1 m. to 1.10 m. The fleece is white though occasionally there are patches of black on the neck and head, and sometimes coffee-coloured animals are to be seen. The wool is straight and not much appreciated on the European markets; the first shearing is the best. When in yolk, the fleece weighs about 2.250 kg., but it loses 50 % in washing. The staple is from 0.15 m. to 0.18 m. in length. These sheep are good walkers, sometimes travelling as far as 400 km., they are very resistant to disease and variations of climate, but are susceptible to thirst and cannot find food in winter if the ground is covered with snow.

They fatten well (producing 30 kg. of fairly good mutton at the age of 3 years), and are good milkers.

In the Government of Aleppo are found: the "moor" variety (of Erzeroum), height 0.75 m.; the rams, unlike the ewes, have a straight forehead. The locks of the fleece which is of a dark red colour, are 0.12 m. long. The moor sheep produces from 30 to 35 kg. of mutton. It suffers from the heat in Syria for it cannot be said to be properly acclimatised.

The "brezi" variety bred by the Kurds, 0.70 m. in height; forehead straight, fleece white, wool straight.

In the Horns-Hanca region are found:

The different "awass" varieties. The *awass deiry* type, called "tchfalich" in Lebanon, and "djefeyli" in Cilicia, is 0.60 m. in height,

0.80 m. in length and has no horns. Its wool is little valued and opinions as to the merits of this sheep differ in the various regions.

The "*hamra*" variety, native of Kurdistan, with red fleece.

The "*avijé*" variety.

The "*brasieh*" variety, tall, hornless, white. The "*tchoum*" and "*carha*" varieties.

In the territory of Great Lebanon, there are: the two types of the "*awass*" variety which seems to have improved somewhat as a result of better feeding.

The "*herrick deraa*" variety which is apparently the "*dziziré*" of Cilicia. Tall, fleece white, hairy parts thick, head and neck black, hornless, mutton of average quality, shows little resistance to disease.

The "*kerbalich-hamra*" variety is distinguished by its height, chestnut fleece and hairless tail; it would appear to be the same as the "*bach-kalé*" of Cilicia and is regarded as one of the finest breeds.

The "*tchafalich*" and "*moor*" varieties.

In Hauran, the "*awass*" variety alone is kept. In the territory of the Alaouites, 50 % of the sheep belong to the "*fallahi*" breed (which is considered indigenous); the animals are small, weighing 45 kg. (when dressed, the yield is 50 %), 40 % belong to the "*awass*" breed and the rest represent different varieties.

The "*moor*" sheep is predominant in the Alexandrette "sandjak", its fleece is often white. This variety fattens well, yielding 50 to 60 % when dressed and it is very resistant. In the sandjak of Djebel Bereket, are found (in order of merit), the "*melemendji*", "*caramanli*" and "*ain-dinli*" breeds the 2 latter are also predominant in Cilicia.

**SHEEP-BREEDING.** — Sheep are reared both by the stationary and the nomadic tribes, the latter possessing the greater number of animals. The flocks raised by the stationary tribes live throughout the year on fallow-land or stubble fields or else travel, according to the pasturage that is available in the district.

Sheep-breeding is not making progress and in certain districts it may even be said to be losing ground owing to the great decrease in the flocks (amounting to 80 % in the region of Alexandrette), which were used for provisioning the Turkish and German troops during the military operations in the country. Any increase in the number of sheep is checked by the scarcity of summer watering places; in autumn and winter the animals are in such a weak condition that they are easily affected by unfavourable conditions of weather. Immense tracts could be utilised for sheep-breeding if the example of South Algeria were followed and numerous watering places made for the flocks. In this way, certain districts might be turned to good account, which at present owing to the shortage of agricultural labour are unlikely to be cultivated for many years.

Epizootic disease is also partly responsible for hindering the development of sheep-breeding; although in the case of stationary flocks, it should be relatively easy for the veterinary service to establish adequate control,

while by restricting the wanderings of the travelling flocks to certain districts, all danger of thus spreading infection could be avoided.

The sheep-breeding industry is well worth development in Syria, for the climate allows the animals to remain in the open throughout the year, while the different products of the flock can command a good market.

**SHEEP-BREEDING CONDITIONS.** — The animals are either reared by the owner himself who pays a shepherd, or else by several associated owners who entrust their animals to a shepherd with whom they share the profits on an agreed scale. The former method is employed chiefly among the stationary breeders.

The author describes the different forms of contract which vary according to district.

Co-operative breeding is fairly common in the Governments of Damascus and Aleppo, especially among the large landowners in the rural districts. The terms of the agreement vary considerably in different places and all forms are described in detail.

**BREEDING.** — As a rule, rams and ewes are used for breeding when 2 years of age, but this takes place earlier or later according to the district.

Animals are rejected for breeding purposes when they are about 5 years old though in some parts of the country, the age is fixed at 3 years, while in others it is extended to 7 or even 12 years e g in the territories of the Alaouites

Rams are as a rule allowed to run with the ewes throughout the year, although in some districts they are kept apart from August to September. Mating begins in July and is sometimes continued until September 15. The number of ewes served by one ram varies considerably in Lebanon, 15 rams are provided for 100 ewes, while in Cilicia (where it is said hand service is sometimes practised) a single ram is put to from 80 to 100 ewes.

Most of the ewes give birth to one lamb, twins being rare and triplets still more unusual. It is reckoned that 5-8 % of the sheep produce twins.

The mortality among the lambs varies with the climatic conditions, but never exceeds 5 to 10 %, and in average seasons the growth of the flock is estimated at from 50 to 60 %. Lambs are separated from their dams a few days after birth, and may then only be suckled twice or thrice a day and are at grass the rest of the time.

**CASTRATION.** — In Hauran and amongst the Alaouites, the young rams are not castrated, but if not required for breeding purposes, are sent at an early age to the butcher.

In Lebanon the operation is effected when the animals are 18 months old, and in Cilicia between the second and fourth month. In the district of Hama lambs are not castrated until they are a year old, as the Arabs consider that the operation stops growth. The usual method adopted is twisting the seminal cord, although in some regions the testicles are removed or crushed. The losses due to castration are computed at 1-3 %.

**IMPROVEMENT OF THE FLOCK.** — Selection and crossing are only carried out on a very small scale and unscientifically. As a rule, breeders aim chiefly at producing a tall animal, but whether this preference is governed by the desire of obtaining good walkers or larger fleeces is not very clear.

**PASTURAGE.** — The home keeping sheep-breeders send their sheep to graze on the fallow-land and stubble fields near the villages while the nomads let their flocks feed in the desert during the winter and spring, and in summer invade the districts occupied by the stationary population, where they are welcomed, as their sheep are supposed to manure the land. In some districts a payment varying in amount is made to the land-owner.

In Syria, besides the mountainous districts, there are regions with meadows that are either perennial or can be pastured for the greater part of the year, e. g. the plain of Amk, lower valley of the Karasu, Harini, Gharb; the plains of Akkar, and Bekaa, the banks of the Euphrates, the pastures of Harash etc.

**SEASONAL AND GENERAL MIGRATION.** — Seasonal migration is rarely followed, for most of the sheep-breeding is in the hands of the nomads; it is, however, practised in some parts of Great Lebanon and is very common in Cilicia where the flocks leave the plains in April and do not return until October. In the sandjak of Djebel-Berket, there are nomad tribes that pass the winter in the plain and spend the summer in the hills.

The author gives a detailed account of the migration of the flocks and describes the manners and customs of the nomad tribes as well as their summer and winter camping grounds. Many of these natives breed camels as well as sheep.

**LACTATION.** — The lactation period varies from 4 to 5 months; the average milk production during the time being 500 gm., this low yield being probably due to irregularity in reeding. The sheep are generally milked once a day; the milk is rich in cream. Except in Cilicia, the milk is consumed by the family, much coagulated milk (yoghourt), butter and cheese being made. In any case, most of the products are used locally.

**SHEARING.** — Shearing begins on March 15 (Cilicia, Aleppo), and is generally continued through April, finishing in May in the upland districts. Owing to the mildness of the climate, the sheep are completely shorn. The animals are not washed before shearing and the weight of the fleeces in yolk varies between 500 gm. (Cilicia), and 2.5 kg. (Hama). The value of the wool varies with the different breeds.

**DISEASES AND PARASITES.** — The diseases that have been identified in Syria are: bacterial anthrax, known as "thal" in Homs-Hama, "tehhaïel" in Hauran, "pohal" in Lebanon, and "hamra" among the Alaouites.

Symptomatic anthrax sometimes occurs. No serious attempts at treatment are made.

Foot-and-mouth disease, called "tibae"; the infected animals are isolated and their hoofs covered with tar or carbolic acid;

Scab, called "djedri"; this disease sometimes attacks 50 % of the flocks.

Verminous bronchitis, known as "dondel el chaar"; distomatosis, called in Arabic "tbou donedar"; "mirara" which appears to be piroplasmosis;

Sarcoptic and psoroptic mange ("djarabe"); the diseased animal is shorn without cutting the skin, washed in soapy water and covered with an ointment consisting of equal parts of tar, sulphur and oil;

The fever called "errojet" is apparently due to flatulence;

Foot-rot which is treated with tar, sulphate of iron baths and various herbs.

Pasteurellosis, contagious pneumonia, jaundice and fleas. Other diseases are rife but cannot be accurately diagnosed.

TRADE IN SHEEP AND THEIR PRODUCTS. — There are three chief branches of trade.

- 1) Importation from the neighbouring region;
- 2) Exportation to the Islands of the Archipelago and Egypt,
- 3) Transactions connected with the local flock

Most of the imported sheep come from Mesopotamia, but this trade has considerably decreased since the War. The animals are sent overland to their destination and details are given of the different routes.

Exportation is very limited and chiefly confined to Egypt and the Islands of the Archipelago.

Most of the meat consumed in Syria and Cilicia is mutton and goat's flesh. At Beyrout the number of sheep, lambs and goats slaughtered in 1920-21 was 69 000. At Aleppo the total number slaughtered was 210 000, of which 100 000 were lambs.

In Lebanon, sheep are fattened for home consumption. In 2 or 3 months the animals weigh from 60 to 80 kg. Their flesh is made into "kawarma", a mixture of fat and meat used as provisions for the winter.

The wool loses at least 50 % of its weight on washing. The fleeces of the animals sent to the butchers' are also put on the market, but fetch 20 % less than shorn wool.

When the wool has been washed and sorted, it is packed for export. The wools of Syria are classed under the heads of.

White, grey, black fleeces.

White, grey, black pelts

Yellow "clips"

The latter are the ends of the fleeces and sell for 20 to 30 % less than the white pelts.

Before the War, the United States were the largest importers of Syrian wool, most of it now (50 to 55 %) goes to France.

The wool that remains in the country is used for making a kind of felt known as "libbadé" (the process of manufacture is here described), ropes, cord and sacking.



A good deal of butter used to be exported, but as exportation from Anatolia is at present impossible, all the butter made in the country of late years has been consumed locally. The much vaunted Aleppo butter is for the most part made in the adjacent districts and brought to the town to be refined. A description of the process is given.

In 1920, 1500 *kantars* of 250 kg. of butter of the value of about 5 500 000 fr. were produced in Hama. Before the War Aleppo sold annually 2 million kg. of the value of some 4 million fr. Owing to the interruption of all commerce with Anatolia this trade has now decreased 50 %.

The district of Aleppo, properly so-called, produced in 1920 the same amount of butter as in 1914, or 20 % of the product that passes under the name of Aleppo butter. The average price is at present 20 fr. per kg.

The sheep-skins are either used locally or exported. There are tanneries in Syria at Aleppo, Antioch, and Zahlé and an account is given of the methods employed.

Skins for export are only slightly salted and dried; most of them come from the abattoirs. Previous to the War, Aleppo exported 250 000 sheep-skins but the number has now fallen to 100 000.

The residuum is exported (in the form of salted intestines) to Germany and Austria, while the horns furnish material for a local industry.

Some statistical data are given in order to complete this study and it is stated that, though it is very difficult to obtain reliable figures the number of sheep may be estimated at 10 466 346. P. C.

458 - **Fertility in Shropshire Sheep, in the United States.** — ROBERTS, E., in *Journal of Agricultural Research*, Vol. XXII, No. 4, p. 231-231. Washington, October 1921.

HEAPE in 1899 made the statement that in some breeds the younger ewes bear fewer twins than the older.

CARLYLE and MAC CONNEL conclude from their observations, made in 1902, that ewes from 3 to 4 years old produced a larger percentage of lambs than younger or older ewes and also that 1-year-old rams were less prolific than 2 or 3 year old rams. The same conclusions were reached by HUMPHREY and KLEINHEINZ from a study of the records of the Wisconsin flock. JONES and ROUSE reported in 1920 that in the case of sheep the percentage of twins increased with age up to 5 years, after which there was a marked decrease.

The author has studied the influence of age and season upon fertility in the American Shropshire sheep. His source of data is the American Shropshire Sheep Record in which he examined 19 367 entries.

**AGE OF EWE AND FERTILITY.** — The percentage of multiple births increases with age up to 4 years and remains fairly constant for 8 years.

**THE AGE OF THE RAM AND FERTILITY.** — The age of the ram has no influence on the percentage of multiple births.

**TIME OF BIRTH AND TWINNING.** — HEAPE, who collected information from flock masters, states that 55 % of them reported that twins were usually born early in the lambing season. The author has found that the percentages of multiple births are 43.1 from January to March, and

36.7 from April to July. In the hope that additional information might be obtained, a study was made of the Dorset breed which produces a large number of young in the autumn. It was found that the percentage of multiple births was highest in the spring, being 48.2 from February to June inclusive as against 34.9 for the other months. F. D.

459 - **Lamb-Fattening Experiments in the United States.** — I. HAMMOND, J. W., Green Forage Crops and Corn for Fattening Lambs, in *Bulletin of the Ohio Agricultural Experiment Station*, No. 340, pp. 35-99, Tables 28, figs. 16, Wooster, Ohio, 1920. — II. PATERSON, A. M., and WINCHESTER, N. B., Lamb Feeding Investigations 1919-1920, in *Agricultural Experiment Station, Kansas State Agricultural College, Manhattan, Kansas, Circular 88*, pp. 6, fig. 1 Topeka, 1921.

I. **TEMPORARY PASTURES AND MAIZE GRAIN FOR FATTENING LAMBS.** — 1st *Experiment.* — Comparisons were made between 1) meadow-grass and colza; 2) grazing alone and grazing + maize grain; 3) grazing and stall feeding, no grass being given.

2nd *Experiment.* — In this experiment comparisons were made between 1) meadow grass, and rye, clover, and rape which were grazed successively; 2) grazing alone and grazing + maize; 3) grazing and stall feeding. In addition, the effect of the ration upon parasitic infestation was also studied.

3rd *Experiment.* — The three comparisons made in the 2nd experiment were repeated and the development of pure Merino lambs compared with that of hybrid Shropshire × Merino lambs.

4th *Experiment.* — Comparisons were made between the different rations of maize given as a supplement to grazing on rape, and the comparison between the Merino and the Shropshire × Merino lambs was again repeated.

The experiments were carried out on the South-Eastern Test Farm at Carpenter, Ohio. The fields of meadow-grass, owing to the character of the soil, were not of the best quality.

In Experiment I the average initial live-weight of the lambs was about 241 lb.; they were kept on grass for 131 days dating from June 14. The average daily increase in live-weight for the lot kept on meadow grass was 0.11 lb. per head, while that for the lot kept on rape was 0.113 lb.; the increase per hectare was, however, 48 lb. and 214 lb. respectively.

In experiments 2 and 3 the average initial live weight of the lambs was about 33 lb. In the 2nd experiment, the average daily gain in live-weight of the lot kept on meadow-grass was 0.34 lb. during the 153 days dating from May 11, and that of the lot grazed successively on temporary fields of rye (8 days), meadow-clover (48 days), and rape (97 days) was 0.40 lb.

In experiment No. 3, the lambs grazed for 160 days dating from May 9. The average daily gain in live weight was 0.175 lb. on meadow-grass, and 0.24 lb. for the lot kept successively on rye (22 days), meadow-clover (36 days) and rape (102 days). As compared with grazing on meadow-grass (experiment 1), grazing on rape gave a higher daily increase in live weight of 2.73 % per head; grazing successively upon land under different

forage crops gave an excess increase of 19.79 % in experiment No. 2 and of 33.06 % in experiment No. 3.

In experiments 1-2-3 one acre of rape produced the same increase in live-weight as 5.04; 9.25; 8.19 acres of meadow grass respectively during the time the animals were left to graze.

In Experiment 1 the land under rape supported 403 lambs per acre for 131 days, and produced 24c lb. or increase in live-weight per acre. In experiment No. 2 it supported 22 lambs per acre for 97 days and produced an increase in live-weight of 185 lb. In experiment No. 3 there were respectively 60 Merino lambs per acre for 77 days, and an increase in live-weight of 203 lb. per acre; 97.5 Shropshire × Merino lambs per acre for 25 days and an increase in live-weight of 166 lb. per acre.

If the value of the land under rape is estimated at three or four times that of meadow-grass pasture, the cost of production per lb. of live weight is about equal.

The rape-fed lambs fattened better and sold at a higher price per kg., their yield as butcher's meat was also higher.

The results of the three experiments show that rape is an excellent forage plant for fattening lambs, especially in districts where good permanent pastures are rare. A temporary rape meadow can also often be used with advantage to supplement meadow-grass pastures during the summer when they are probably dried up, uninviting and infested by gastro-intestinal parasites left by the sheep.

As regards the effect exercised by the pasturage upon parasitic infestation, it was noted in experiment No. 2 that almost the same number of stomach-worms were present in animals turned out on to natural meadows, as in those that had grazed on temporary pasture land. The first had, however, the larger number of intestinal nodes.

The half-bred Shropshire × Merino lambs gave per acre of land under rye or meadow-clover, a larger increase in live-weight than the Merino lambs similarly fed. The results varied, as regards the animals kept on rape, sometimes in favour of the half-bred lambs, sometimes in favour of the Merinoes. The half-bred lambs reached a higher degree of final fattening.

*4th Experiment.* — This took place at the Wooster Experiment Station (Ohio) and was carried out in order: 1) to determine the economy of giving a whole or half ration of maize as a supplementary food for lambs kept on rape fields; 2) to compare Shropshire lambs with half-bred Shropshire × Merino lambs as regards the cost and character of the live-weight produced by grazing on rape and the rate at which it is obtained. For this experiment 6 lots of 10 sheep each were chosen and the animals used in the preceding experiments, Nos. 2 and 3, served as control lots for the following years. Feeding a supplementary maize ration augmented the increase in live-weight: this increase was 11.5 % the first year, and 35.5 % the next, in the case of the lots kept on the meadow-grass field; and 12.6 and 21.1 % for the lots on the fields planted with other crops;

in addition, the dressing-yield and the value per lb of live weight increased in all the cases

The experiments at Wooster were made in 1917 with improved but not pure-bred Shropshire lambs of an average initial weight of about 53 lb, and with half-bred Shropshire  $\times$  Merino lambs of an initial weight of some 46 lb. Both lots were kept on rape and divided into 3 groups receiving respectively a whole supplementary ration of maize (i.e. the whole ration that could be consumed in one morning), half a supplementary ration (what they found on the temporary pasture in the case of the control group). The average daily increase in weight per head was 4.5 oz in the case of the Shropshire, and 5.3 oz for the hybrid lambs in the control groups, as against 5.0 oz and 5.3 oz respectively in the group receiving the supplementary half ration, and 5.4 oz and 5.5 oz in the group given the whole supplementary ration. There was practically no difference in the final degree of fattening, nor in the yield at the butcher's.

It is true that the half bred lambs had a slight advantage as regards rapidity and economy in the increase in live-weight and the increase in weight per surface unit but further experiments are necessary before this superiority can be clearly established.

II LAMB FEEDING EXPERIMENTS IN IDAHO 1919 1920. The two sets of experiments described in the bulletin analysed were made for the purpose of comparing rationing with self feeding and of determining the comparative value of several concentrated feeds.

*First Experiment* — Five lots of 40 lambs with an average initial weight of about 55.7 lb were fed as follows for 64 days beginning on November 2, 1919. 4 lots were given 1.25 lb grain + 0.14 lb linseed-oil meal in addition to lucerne hay and cane silage the other lot was self-fed and consumed 1.40 lb shelled maize and 0.55 lb linseed-oil meal per head and per day. The last lot ate less bulky feeds than the hand fed lambs, made 0.03 lb greater average daily gain per lamb fattened better and gave a higher dressing percentage (50.06). Of the other lots No. 2, fed shelled maize gained daily 0.48 lb per head. No. 5 fed shelled maize and given in addition stock tonic gained 0.47 lb daily per head. Lot No. 3 fed ground maize also gained 0.47 lb daily per head while the lowest daily gain per head was made by the lambs of lot No. 4 which was fed whole barley. The dressing percentage of this lot was also the lowest. The dressing percentage for the 4 groups was respectively 49.1, 49.5, 48.8 and 48.2.

*Second Experiment* — This began on February 8, 1920, and lasted 30 days. 6 lots of 35 lambs each were used. The initial weight of each animal was about 73 lb and the final weight about 88 lb.

The self-fed lot (No. 1) were given daily per head 1.52 lb shelled maize + 0.49 lb linseed oil meal + 1.05 lb lucerne hay + 0.98 lb maize silage and made an average daily gain of 0.55 lb per lamb. The same average daily gain was made with the hand fed lambs (lot 3). The daily ration per head of the hand fed lambs was — shelled maize 1.10 lb + linseed oil

meal 0.23 lb. + 1.07 lucerne hay + 2.10 lb. maize silage. The self-fed lot ate more maize and less silage than the hand fed lot.

When linseed-oil meal was left out of the basal ration of the hand-fed lambs (Lot 6) the average daily gain per lamb was only 0.42 lb., whereas the gain of the self-fed lambs (Lot 2) given the same food was 0.54 lb., with the consumption of 1.62 lb. maize per head and per day.

The hand-fed lot (No. 3) fed linseed-oil meal made 0.01 lb. less average daily gain per lamb than those receiving 34 lb. maize gluten feed (lot 5).

Lot 4 which was only fed shelled-maize and lucerne hay made a daily gain of 0.47 lb. per head and fattened less than any of the others.

The feed required for 100 lb. gain was as follows :

Lot 1. 276.27 lb. shelled maize + 88.86 lb. linseed oil meal + 190.36 lb. lucerne hay + 177.88 lb. maize silage.

Lot 2. 301.77 lb. shelled maize + 195.27 lb. lucerne hay + 205.46 lb. maize silage.

Lot 3. 190.66 lb. shelled maize + 41.52 lb. linseed oil meal + 195.16 lb. lucerne hay + 382.27 lb. maize silage.

Lot 4. 225.66 shelled maize + 498.63 lb. lucerne hay.

Lot 5. 186.78 lb. shelled maize + 61.02 maize gluten feed + 191.70 lb. lucerne hay + 348.73 lb. maize silage.

Lot 6. 248.76 lb. shelled maize + 255.30 lb. lucerne hay + 468.85 lb. maize silage.

Fat lambs weighing from 80 to 85 lb. are in greatest demand on the market. Therefore lambs weighing around 55 lb. are the most profitable type to feed. The larger type of feeding lamb is not fat enough at 85 lb. and is too heavy to command a profitable price. F. D.

460 - **Swine-Feeding Experiments in Kansas, United States.** -- FERRIN E. F., and WINCHESTER, H. B., in *Agricultural Experiment Station, Kansas State Agricultural College, Manhattan, Kansas, Circular 80*, 10 pp. Topeka, 1921.

A COMPARISON BETWEEN BARLEY AND MAIZE AS A SUPPLEMENTARY FEED FOR PIGS ON PASTURE. — Forty pigs divided into 4 lots of 10 each, were used in this experiment which lasted 120 days, beginning from July 1, 1919.

One pig out of Lot 1 died. The average initial weight of the animals was about 37 lb. The rations fed and consumed are given in Table I.

These results show that maize grain is more satisfactory for fattening pigs than barley which is too bulky owing to the large quantity of hull. In the preparation of barley, grinding gives better results than soaking the grain, especially if the feed is to be given to young pigs.

THE COMPARATIVE FEEDING VALUE OF MAIZE AND LOW-GRADE WHEAT. — This experiment lasted 120 days beginning on September 15, 1919. Most of the pigs used had been running on lucerne pasture until the test started from which time they were fed in dry lots. Fifty pigs were secured for the experiment, and their average initial weight was about 60 lb. The rations fed and their relative efficiency are shown in Table II. It may be said that, given equal amounts larger returns are obtained from

wheat than from maize; hence if the prices are approximately equal, wheat is to be preferred to maize.

TABLE I — *Barley versus Maize for Pigs on Lucerne Pasture.*

Food	Feed required for 100 lb. gain			
	Lot 1	Lot 2	Lot 3	Lot 4
	lb	lb	lb	lb.
Shelled maize	306.78	—	—	—
Dry ground barley.	—	352.15	—	—
Soaked ground barley (1)	—	—	413.87	—
Soaked whole barley	—	—	—	433.01
Tankage	28.78	26.17	31.69	32.74
<b>Totals</b>	<b>335.56</b>	<b>378.32</b>	<b>445.56</b>	<b>465.75</b>
Relative efficiency of rations in % on basis of least feed for 100 lb. gain	100.00	88.69	75.31	72.01

(1) The soaked barley only remained in water from one feeding to the next in order to avoid souring

TABLE II — *Comparison between Maize and Low Grade Wheat in fattening Pigs*

	Feed Required for 100 lb Gain				
	Lot I	Lot II	Lot III	Lot IV	Lot V
	lb	lb	lb	lb	lb
Whole wheat	390.06	—	—	—	—
Ground wheat	—	402.88	466.51	245.77	—
Ground rye	—	—	—	45.77	—
Ground maize	17.85	—	—	—	485.27
Tankage	—	19.30	—	—	22.23
<b>Totals</b>	<b>407.91</b>	<b>422.18</b>	<b>466.51</b>	<b>491.54</b>	<b>507.50</b>
Relative efficiency of rations	100	96.62	87.44	82.98	80.38

VALUE OF RYE AS A SUBSTITUTE FOR MAIZE — This experiment was made on 5 lots of 10 pigs with an average initial weight of about 60 lb., it lasted 120 days beginning on September 15. The results given in Table III, show that in times of high-priced maize, rye if available can probably be used to a larger extent than hitherto. Some more palatable food should however be mixed with it.

GRAIN SORGHUMS COMPARED WITH MAIZE — An experiment lasting 60 days and beginning on February 17, 1920. Two groups of pigs were used, one farrowed in the spring, and the other in the autumn. Each

TABLE III. — *Rye as a Substitute for Maize in Pig Feeding.*

Ration	Feed required for 100 lb. gain				
	Lot I	Lot II	Lot III	Lot IV	Lot V
	lb.	lb.	lb.	lb.	lb.
Ground rye. . . . .	245.77	—	486.58	243.80	279.88
Ground wheat. . . . .	245.77	—	—	—	—
Ground maize. . . . .	—	485.27	—	243.80	—
Wheat shorts. . . . .	—	—	—	—	273.26
Tankage. . . . .	—	22.23	23.60	30.48	—
Totals. . . . .	491.54	507.50	510.18	518.08	553.14
Relative efficiency of rations. .	100.00	96.85	96.34	94.87	88.86

group was divided into 4 lots of 5 pigs. The various lots were fed ground maize or sorghum, and tankage. The results, given in Table IV show that sorghum grains, especially milo and feterita, are nearly as good as maize for feeding pigs and may possibly be better than maize for fattening-purposes.

If sorghum is substituted for maize, more tankage is needed. The right quantity of tankage was fed in this experiment, viz., 3.7 % of the total feed consumed in the case of 150-pound pigs and 4.7 % in that of 100 lb. pigs.

TABLE IV. — *Effect of the Age of the Pigs upon the Amount of Feeds required for One lb. Gain in Live Weight.*

Age of Pigs	Initial weight	Maize ration per lb. gain			Feterita ration per lb. gain			Milo ration per lb. gain			Kafir ration per lb. gain		
		Grain	Tankage	Total	Grain	Tankage	Total	Grain	Tankage	Total	Grain	Tankage	Total
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Months													
5½	100	4.54	0.19	4.73	5.00	0.27	5.27	5.07	0.25	5.32	5.58	0.27	5.85
9	150	4.25	0.15	4.40	4.09	0.17	4.26	4.53	0.18	4.71	4.76	0.17	4.93

F. D.

461 - Concentrated Pig Foods. Experiments made in France. — DE MARSAY, Vte H., and BAUDOUY, in *Journal d'Agriculture pratique*, Year 85, Vol. II, No. 45, p. 396, Paris, November 12, 1921; year 86, Vol. I, No. 6, p. 122. February 11, 1922.

I. — From September 14 a lot of 14 pigs weighing 1067 kg. were given as much as they could eat for 20 days, during which time they gained in

weight 218 kg representing a pecuniary gain of 4 30 fr (cost of 1 kg. of live-weight)  $\times 218 = 937$  40 fr The cost of the food was as follows:

420 kg manioc meal at 0 66 fr the kg	277 20
240 kg barley meal at 0 70 fr the kg	168 00
100 kg pea nut meal at 0 56 fr the kg	56 00
700 litres whey at 0 05 fr the litre	35 00

536 20

Gross profit 93 40 fr — 536 20 fr = 4 120 fr

Grain per pig and per day 401 20 fr. 2.80 — 1 44 fr

II — 85 rationed pigs given 3 to 4 kg whey + 1 kg manioc + 1 kg barley + 0 5 kg pea-nuts, or a ration costing about 2 francs, also gave a good return with meat at the present price

III — A hundred pigs were fed the following ration 500 gm maize + 500 gm sorghum + 1000 gm palm-oil cake + 500 gm pea-nuts + 200 gm. bone-meal + several litres of whey, distributed as follows palm-oil cake, pea-nuts, bone meal crushed sorghum mixed with whey and given warm in the morning the same ration in the evening maize grain at midday Sorghum fed whole is not digested well but is very digestible when either ground or crushed

After 30 days the following results had been obtained

Daily gain of unrationed pig fed maize (consumption 1 300 kg)	120 kg
Daily gain of rationed pig fed maize ( 500 kg)	0 668 "
Cost of feed of unrationed pig	2 80 fr
Cost of ration of hand fed pig	1 52 "
Daily profit of unrationed pig at 4 fr per kg of live weight)	1 308 "
Daily profit of hand fed pig	1 152 "
Difference to the advantage of unrationed pig	1 156 "

In all these experiments the cheapest concentrates obtainable were fed

From the results the following conclusions may be drawn

1) Nothing is gained by rationing pigs it is much better, to give them food *ad lib* 2) At the present time it pays very well to feed pigs on judiciously chosen concentrates

F D

## BEEKEEPING

462 — **Apiculture in Cuba and the Purity of Cuban Honey.** — (Communication made to the Permanent Committee of the International Institute of Agriculture by Dr F I FALCO, Delegate of the Republic of Cuba)

Bee-keeping is very popular in Cuba, and recently on the initiative of the Reorganisation Commission of the National Agricultural Services of the Republic, a great deal has been done to develop in every way this branch of rural economy and to stimulate actively the improvement of the breeds

The flora of Cuba is the richest and most varied in the botanical region of the Antilles and includes a large number of native species, as well as of species imported both from temperate and hot countries; it is therefore able to supply the bees with materials of excellent quality for honey-making It is reckoned that there are over 50 species of hon-



ey-bearing plants in the island ; of these some of the most important are *Aguinaldo blanco de Pascuas* (*Ipomoea sidaefolia* Choisy), which opens its flowers at dawn and closes them at three o'clock in the afternoon, and *Aguinaldo rosado* (*Ipomoea triloba* Lin.), from which the bees make the *aguinaldo* honey which has a reputation for the most delicate and delicious flavour.

The State Agricultural Experiment Station has instituted a model apiary that has of late been much developed, and has introduced selected queens of Italian stock, in order to obtain queen-bees of first rate quality for distribution to bee-keepers who wish to improve their stock of the Caucasian, Carniola, and Cyprus breeds, for in this way very satisfactory results have been obtained. The Entomological Department attached to this Station has also created a Service for the protection of bees against their natural parasitic enemies, the insects belonging to the family of the *Galleriidae* (*Galleria mellonella* and *Achroea grisella*).

Apiculture is continually on the increase and is the source of a large export trade of Cuban honey which until quite lately was much appreciated in other countries.

Recently the purity of this Cuban product has been called in question in some European countries, and this has been the occasion of a very careful investigation on the part of the interested Official Authorities of the Republic. The results of this investigation are here set out for the information of the International Institute of Agriculture by the delegate of the Cuban Republic.

Since the analyses of the honeys from Cuba had led to different conclusions, some of the honeys being regarded in many countries as of undoubted purity, while in others, importation is being checked owing to the alleged presence of invert sugars as revealed by the furfural reaction, the Laboratory of Agricultural Chemistry of the Republic resolved to make a thorough investigation of samples of known genuineness and purity, in order to be able to determine conclusively the percentage composition and qualitative characters of the chemically inverted sugar and artificial glucose probably used in the adulteration of the honey. The system followed was with slight variations that adopted by the Bureau of Chemistry of the Department of Agriculture of the United States, the object being to discover some explanation of the different treatment given to Cuban honeys by the Custom-House Officials of certain countries.

This investigation revealed that the difference was the result of analysis according to two different systems. In fact when FIEBE's hydrochloric resorcin method was adopted, the furfural colour reaction was obtained owing to the presence in almost all genuine Cuban honey of a substance, which by its special chemical action affects the reagent whereas no reaction takes place at all with BROWNE's anilin acetate method.

The first phenomenon is explained by the fact, that as many of the apiaries are situated near the sugar factories in Cuba, large quantities of saccharose are frequently within reach of the bees. They collect the saccharose on their feet and deposit it on the comb, as has been found by

analysis carried out according to the FIEHE process. Saccharose has also been detected in the honey from apiaries near the factories, although it is not found in the product of those at a greater distance, as for instance in the honey from the Isla de Pinos. Thus the presence of this sugar must be regarded as a natural characteristic of the product. Further saccharose only occurred in very small quantities in the cases quoted, the amount never exceeding 0.25 per 1000.

The report prepared from the results of the investigations at the Laboratory of Agricultural Chemistry sets forth very graphically the data obtained, and shows that FIEHE's method for the detection of adulteration of honey gives misleading results in the case of the Cuban products, and that the experiments carried out at the State laboratories of Cuba and of the United States alike have proved to demonstration the necessity for adopting the BROWNE process.

The Head of the Department of Chemistry of the Ministry of Agriculture of the Republic as a result of analyses made in the laboratories under his control, and of similar investigations made by the United States Bureau of Chemistry of the Department of Agriculture, and also taking into account the genuine nature of the samples analysed, has formulated the following conclusions.

*First* : Cuban honeys have a homogeneous chemical composition varying within very narrow limits and differing very little from the composition of honey from other countries.

*Second* : By far the greater part of Cuban honeys have the property of producing with hydrochloric resorcin a colour reaction that gives the erroneous impression that these honeys which have been recognised as pure, have been adulterated with chemically obtained invert sugars.

*Third* : In the light of these facts FIEHE's method should not be employed in the analysis of honeys made by Cuban bees.

*Fourth* : BROWNE's anilin acetate method should be exclusively recommended as the only sure test for Cuban honeys suspected of adulteration with invert sugars.

F. F. F.

463 - Treatment of "Acarine Disease" (Isle of Wight Disease), of Bees. (1). — ALLEN W., in *British Bee Journal*, Vol. XI, IX, No. 2040, pp. 344-345. London, July 28, 1921.

In his experiments in controlling Isle of Wight disease the author has found the fumes of ammonium sulphide to be most efficacious and quite innocuous to the bees. A pad of cotton-wool dipped in ammonium sulphide is introduced between the diaphragm and the wall of the hive, which is covered to prevent the escape of the fumes. Two days after treatment all the symptoms of the disease have disappeared.

(1) See R. July 1921, No. 748. Dr. RENNIE and his collaborators have stated that Isle of Wight Disease differs from the disease caused by *Nosema aphs*. The agent is a mite *Tarsonemus woodi*, which invades the tracheal system of the bee. Dr. RENNIE suggests for this malady the name of acarine disease. (Ed.)

Allyle sulphide is equally efficacious, but is much more pungent, and very dear, whereas ammonium sulphide is cheap and easily procured.

F. D.

- 464 - **The Present Condition of Sericulture in Syria.** CROIZAT, in *Revue de Botanique appliquée et d'Agriculture coloniale*, Year II, Bull No 5, pp 28-29 Paris, January 30, 1922

SERICULTURE

According to a report by the author published by the Lyons Chamber of Commerce, the output of cocoons in Syria previous to 1914 was about 4 500 000 kg 3 700 000 being produced in Lebanon and the Plain of Beha, and 800 000 in the district of Antioch. These cocoons furnished 300 000 kg. of silk, most of a very fine quality, which was destined for the French market. The mulberry was cultivated everywhere on a large scale. The silkworm eggs were brought from France in refrigerators which made it possible to obtain fairly good products, although all modern method of silkworm breeding were totally unknown in Syria.

After the War broke out, no more silkworm eggs arrived, the native "seed" produced worthless stock and finally the mulberry trees were dug up in order that food crops might be planted in their place. As a result there was a great reduction in the number of cocoons obtained which in 1919 was only  $\frac{1}{4}$  of the pre-War total in Lebanon although the importation of "seed" had been resumed, and had fallen to  $\frac{1}{8}$  in the district of Antioch where native "seed" was still used.

G. A. B.

- 465 **Observations and Researches on the Causes of the Persistence and Diffusion of Pebrine in Italy, notwithstanding the Selection of the Silk-Worm Eggs.** - MONTANARO N. (Istituto Ricerche, Portici) in *Informazioni seriche* Vol IX, No 3, pp 34-39. Rome February 5, 1922.

Although from the industrial point of view it may be said that pebrine has been conquered (for the silkworm breeder is always sure of being able to obtain healthy eggs and he is not concerned whether the cocoons he obtains contain healthy chrysalids), the disease is still very wide-spread, and it frequently happens that all or most of the moths reared from sound "seed" contain the characteristic spores.

This can be explained by 4 hypotheses:

- 1) The selection methods do not give results sufficiently perfect to eliminate entirely, infected eggs.
- 2) Breeding from infected eggs, though forbidden by law still takes place.
- 3) The germs of the parasite possess greater powers of resistance to external surroundings than has hitherto been commonly supposed.
- 4) The disease may attack other insects and therefore persist independently of the silkworm.

The author has tested experimentally the truth of the 4 hypotheses especially the first, and his results may be summarised as follows:

- 1) Of all the methods proposed for the elimination of infected moths, PASTEUR's is still the best. The negative importance of the male

in the transmission of the disease has once more been proved, for though in some experiments the malady was conveyed by the male insect, these cases were exceptional. Sound progeny can be obtained from *slightly* infected females. Thus the first hypothesis may practically be discarded.

2) One of the chief causes of the persistence of pebrine lies in breeding from uncontrolled "seed", or seed purchased from travelling dealers, or from abroad; frequently also eggs bred by the peasants are mixed with those bought.

3) The results of PASTEUR'S experiments, although not always uniform, were sufficiently general to justify the conclusion that pebrine germs lose their infectious character after drying in the air. Several other experiments have shown, however, that they are endowed with considerable powers of resistance. HUTCHINSON found that the spores continued to live in a dry medium for over 5 months and therefore their life in a damp medium would probably have been longer. The author's experiments, which are not yet finished, confirm HUTCHINSON'S statements. It is quite possible that other insects beside the silkworm harbour the pebrine parasite, in fact *Nosema bombycis* infects other Lepidoptera, such as *Gastrophaca neustria*, *Arctia caja*, *Attacus* (*Saturnia*) *pernyi*.  
F. D.

466 — The Use of Low Temperatures to destroy *Bombyx* Chrysalids. — DI TOCCO R., in *Informazioni seriche*, Vol IX, No 4, p. 57. Rome, February, 20, 1922.

As some silk-worm rearers have suggested the use of low temperatures for destroying the chrysalids of *Bombyx*, the author takes occasion to advise that none of the expensive apparatus required should be installed for the present, as with low temperatures the natural moisture of the cocoons cannot be absorbed as it is by storing, and the treatment is a lengthy one owing to the great summer heat, the high temperature induced by heaping up the cocoons, and the bad conductivity of the outer silk. The chief objection is however the uncertainty of the process.

Although silkworms themselves die at 8-10° C below 0° C, (SPALLANZANI), their eggs can resist, for a short time, much lower temperatures (BONAFOUS, FRIZZONI, QUAIAT), and the chrysalids take no harm, even when exposed for successive generations to temperatures below -12° C. This fact has been proved by the experiments of Prof. COLASSANTI (briefly described by the writer) of which an account was published as long ago as 1879 in the *Rendiconti dell'Accademia medica di Roma*.

F. D.

## FARM ENGINEERING.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

467 — Tractor or Motor-Plough? — SCHEMPF, in *Deutsche Landw. Presse*, No. 53, pp. 400-401. Berlin, July 6, 1921.

The author makes a comparison between tractors with motor-ploughs after a consideration of the results of the tests at Zuffenhausen (Stuttgart).

In ploughing heavy land to a depth of 20-22 cm. the tractor appear-

ed to be slightly superior to the motorplough. The furrow turned by the towed plough was better finished than the furrow made by the mould-boards of the motor-plough. The tractor also seemed easier to drive.

A 2nd test was made on very heavy, uneven land, where the tractor proved itself clearly superior to the motor plough, whose work was continually interrupted by hillocks between the mould-boards.

In the case of skidding, it was found that the wheels of the motor-plough when reversed were quite as liable to slip. With a tractor the difficulty can be better got over by the use of a chain or cable.

The results from the point of view of fuel consumption are not yet known. G. B.

468 - **One-Wheel Tractor, L' Hermite System.** — WEISS E., in *Le Génie Civil*, Vol. LXXX, No. 6, pp. 133-134. Paris, February 1922.

An agricultural tractor should be able to turn on the field like a single-horse; it ought therefore to be as easy to drive as a horse-drawn vehicle.

L'HERMITE has followed these principles in the construction of his new model tractor. This tractor has one large driving-wheel only which can turn on the field; the motor engine forms with this wheel and the accessories, a complete machine that can be pivoted on a horizontal circular attachment. This attachment carries the connections for the machines, just as a horse's harness is provided with the means of linking up with the vehicle.

The only other movable part is the central driving-wheel; hence the strength of the tractor, and the suppression of the speed-gear. The gear-case is placed in the nave of the driving-wheel.

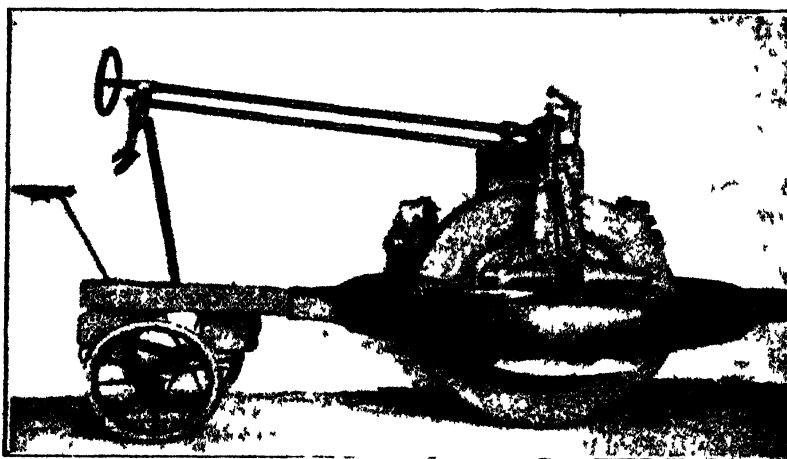
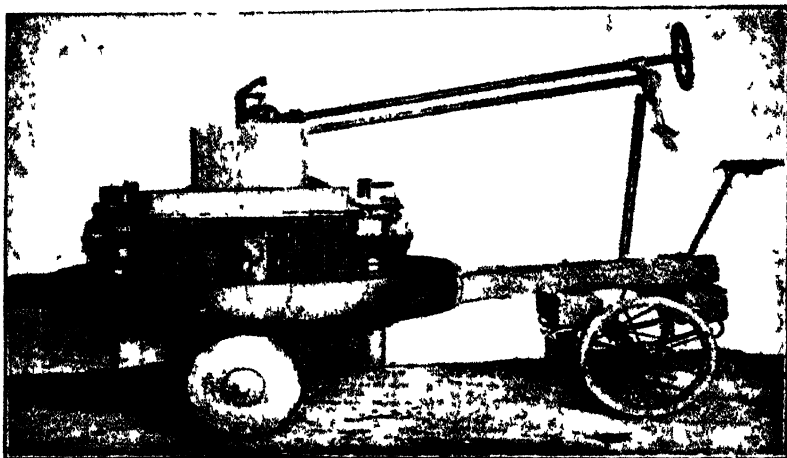
The engine is valveless, has 2 horizontal cylinders and the distribution is very simple. A hollow cylinder communicates in the centre with the carburettor; at each extremity, it has an oblique partition which during rotation, puts the pipes supplying the cylinder in communication both with the centre of the tube for the aspiration of the carburetted mixture, and with the exhaust. To compensate for side slip a trailing wheel of small diameter is added.

The cooler consists of small vertical tubes and detachable circulating linings that are easily replaced.

Attached to the frame are horizontal rollers supporting large horizontal circular attachment which entirely surrounds the engine as the harness envelops a horse; thus the driving-wheel can at once revolve *in situ* within it. Changes of direction can be effected as quickly as in the case of a horse, and the machine can go in either direction. The steering apparatus is of a simple character and the forward and backward movement as well as the speed control are regulated by a lever.

The tractor can turn within a radius of 1 m., and can be used with a two-way plough. The tractor is placed between the two series of shares, the frames of which are arranged symmetrically to the axis of the tractor which is also the axis of turning.

The driving wheel works parallel to the direction of the plough and change of direction is made after the reversal of the shares. A supporting-wheel is placed behind each plough to regulate the depth of ploughing. In short this tractor has been specially designed for agricultural work.



One wheeled Tractor L'HERMITE.

P. C.

469 - "Massimo" Tractor, for Ploughing on Slopes. — CASTELLI M, in *La Macchina nell' Agricoltura*, Year II, No 1 pp 6-8, figs 5, Milan, January 1922

This tractor has 4 wheels, 2 driving-wheels at the back; 2 steering-wheels in front; motor-car type; runs on petrol, develops 25 H P.; rigid suspension; all transmissions by means of gearing; weighs 2600 kg. when

ready for work. This tractor is especially adapted for ploughing in hilly i. e., on uneven ground with steep slopes up to 3/10: the steering mechanism oscillates with parallel movement; the back wheels are small with a vertical displacement; transmission to the back wheels is effected by pinions engaging with an internal cog wheel attached to the wheel-body, the whole being enclosed and running in grease; reversible action; simple method of attachment.

Several experiments have been made with this tractor, and the results obtained were perfectly satisfactory. F. D.

470 - **The Heavy-Oil Engine for Agricultural Purposes.** — MÜLLER B., in *Deutsche Landw. Presse*, No. 59, p. 439. Berlin, July 27, 1921.

The author demonstrates the advantages of this type of engine from the points of view of safety, easy handling and small cost of motor-power. Practical experiments have shown that it consumes 220 gm. only of heavy oil per horse-hour. This fuel is much less expensive than petrol or paraffin. G. B.

471 - **Means of Attachment for Tractors to Farm Vehicles.** — *Deutsche Landw. Presse*, No. 45, pp. 342-343. Berlin, June 8, 1921.

The object of this apparatus is to enable ordinary farm-carts to be drawn by a tractor. After removing the pole, a bar connected by means of rods with the forecarriage is fixed on the front; in this manner, all the strain is transferred to the fore carriage. G. B.

472 - **Windlass for Cable Ploughing which Automatically changes its Position in Two Directions.** — CASTELLI M., in *L'Italia Agricola*, Year 58, No. 10, pp. 305-309. Piacenza, October 15, 1921.

The author, who has invented the apparatus described in this article, proposes to use it for the intensive cultivation of flat and hilly country for which the present large cable-drawn tractors are unsuited. As compared with such tractors, this windlass provides the necessary traction force, at about half the cost for installation. It may be called a single engine funicular apparatus whose working is eased as no ploughing is done on the return journey (which is made twice as quickly as the outward journey, during which the actual ploughing is done), and by a considerable reduction in the length of the furrows.

The windlass-cart carries the engine which is preferably driven by electricity, the transmissions and 2 drums upon which are wound the working and the return cables; these move together and their movement is transmissible also to the chief trailing-wheels whose axis is parallel to the axis of the drum. If the engine is driven by electric power, the movement is only used in the field. In order to anchor the windlass-cart, a traverse or skid is lowered carrying nearly all the weight. Any longitudinal movement in the direction of the furrows is thus prevented, whereas transverse changes of position are rendered possible by the sliding of the skid over the ground. On the opposite headland is anchored a light return pulley which is easily moved by hand during ploughing.

An ordinary plough is used ; to this can be attached a roller with a guiding-lever which facilitates its return when empty. An automatic self-raising plough of the type used for tractors, but with some slight modifications can be employed. The plough when working is drawn directly towards the windlass, that is to say without any return or deviation of the rope which is therefore not liable to become worn.

As soon as the plough has reached the windlass, the driver reverses the movement of the drums and the plough at once begins to return ; at the same moment, by the action of a small windlass also controlled by the engine, the patten supporting the windlass-cart slides along the headland changing its position by as much as the width of one or more furrows.

F. D.

- 473 - **Plough for the Rudolf Sack Tractor.** — *Deutsche Landw Presse*, No 55, p 413. Berlin, July 13, 1921

This plough is made with 3 and with 2 mould-boards worked in the first case with a rope, and in the second with a lever. The ploughing apparatus consists of an excentric that controls the nave of the land-wheel by means of a chain attachment.

G. B.

- 474 - **Notes on Implements for Motor-Ploughing.** — STENDJ, in *Deutsche Landw. Presse*, No 43, p 327 Berlin, June 1, 1921

The author gives some information regarding the different W. D. implements and their use

The W. D. motor-plough is provided with a 80 HP. engine and carries 5 mould-boards, a second type has an engine developing 35 HP. and is fitted with 3 mould-boards. The W D tractor is of the caterpillar type ; its engine develops 20 HP.

G. B.

- 475 - **Method of Fixing Mould Boards on Ploughs, Deutsche Last-Automobilfabrik System.** — *Deutsche Landw Presse*, No 43, p 327 Berlin, June 1, 1921

The frame bearing the mould-board is fixed on the chassis in such a way as to be able to rise vertically, and slope backwards when the plough meets with any obstacle ; two compensating springs control the displacement and bring back the frame into its normal position.

G. B.

- 476 - **Richter Hoe for Potato Ridging.** — *Deutsche Landw Presse*, No 35, pp 268-259. Berlin, May 4, 1921

In the present type of machine, the blades are adjusted to the slope of the sides of the ridges, by turning on a pivot inclined in the direction in which the machine is travelling. The new machine provides for a second movement, round a vertical axis. By this means, the blade is able to adapt itself both to the slope and to the height of the ridge, so that the edge is prevented from coming into contact with the plants.

G. B.

- 477 - **Working the Soil with a Disk Harrow.** — BIPPART, in *Deutsche Landw Presse*, No 53, p 400 Berlin, July 6, 1921

The author examines the different kinds of work executed with a disk-harrow, or pulveriser. It is a mistake to use this implement in



the spring for working the soil to a depth of 15 cm. The mass of soil is too much disturbed and as a result of the contact of the earth with the air, the water evaporation is intensified which is very injurious, especially as the spring is generally followed by a period of drought.

When it is necessary to make a layer of granular soil on the surface of the ground, such as is obtained with a rotary plough, the disk-harrow brings about this result with the expenditure of less energy than any other implement. The author mentions other cases in which it can be employed: fallow land that has been ploughed in the autumn should be disk-harrowed in spring to decrease evaporation and hasten the germination of weed-seeds. The disk-harrow is well adapted for the destruction of weeds and also for breaking up stubble after cereal crops have been carried.

G B

478 - **Renniger's Apparatus for Cleaning Seeds.** *Deutsche Landw. Presse* No. 33, p. 255. Berlin, April 27, 1921.

This apparatus is especially adapted for cleaning seeds such as those of the poppy, clover, etc. It consists mainly of a series of sieves of which the action is completed by rubbing plates.

G B

479 - **Breite Potato Sorter.** — *Deutsche Landw. Presse*, No. 9, p. 222. Berlin, April 13, 1921.

The rotating type of potato-sorter requires a very long cylinder for satisfactory working. In order to diminish the length of the apparatus and make it easy to carry when sorting is done in the field, and also easier to store, the drum is so constructed as to be capable of extension while folding together bellow-wise.

G B

480 - **Carlson Straw Press combined with Thresher.** — *Deutsche Landw. Presse* No. 21, p. 163. Berlin, March 16, 1921.

The press is placed at right angles with the thresher and its hopper receives the straw from the shakers. Thus the axle of the guiding pulley is perpendicular to the driving shaft of the press. The gearing apparatus is patented; it consists of a frame that can be applied either to the right or the left side of the press. The pulleys altering the direction of the belt can be regulated both for height and direction.

G B

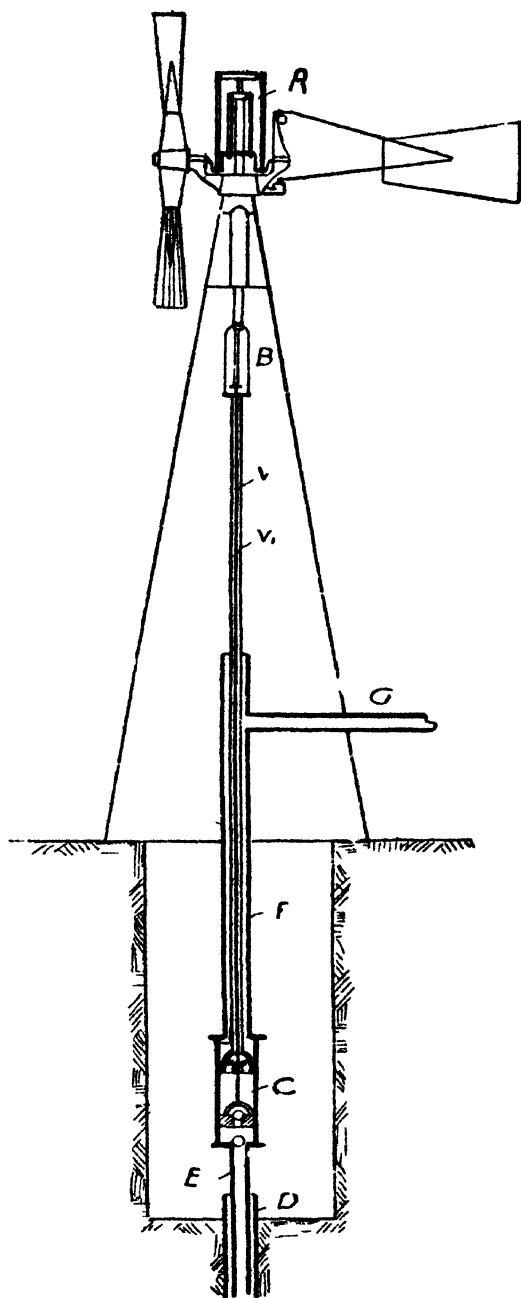
481 - **Automatic Distributor of Oats for Horses, Mische System.** *Deutsche Landw. Presse* No. 45, p. 313. Berlin, June 5, 1921.

This apparatus includes a regulator, a braked motor and the oat distributor. It works without springs, the oats falling into a vertical hopper into which they are poured by a horizontal transporting canvass set in motion by the mechanism.

G B

482 - **Double Stroke Wind Engine.** — *CONTI M. Leisti de la Facultad de Agronomía y Veterinaria*, Vol. III, Part 3, pp. 294-306, figs. 5. Buenos Aires, December, 1921.

An improved type of ordinary wind-engine invented by Félix ROJÁN and tested with complete success at the "Instituto experimental de Mecánica agrícola" of the Agricultural and Veterinary Faculty of Buenos Ay-



No 482, Fig 1

*Diagram of the Construction of a  
Double Stroke Wind Engine*

*A* = mechanism

*B* = guide for the two concentric  
rods *V* and *V<sub>1</sub>*

*C* = double stroke cylinder

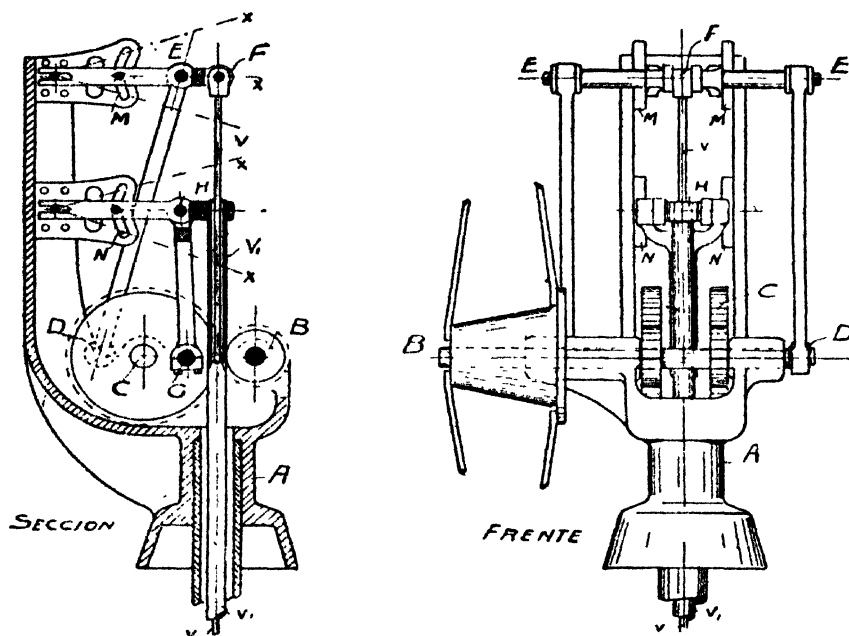
*D* = perforation

*E* = suction pipe

*F* = elevation pipe

*G* = discharge pipe

res under the direction of the author. The improvement consists in the use of a double balance to control the working of 2 concentric piston-rods thus providing for a cylinder with double piston and hence with an up and down stroke, the one rod rising as the other falls. The weights of the rod and of the tube which acts as an external rod are equal and balance one another, thus obviating the difficulties caused in ordinary wind en-



No. 482, Fig. 2. — Mechanism of Double Stroke Wind Engine.

SECCION = Vertical section

FRENTE = Front view of mechanism.

A, cast-iron socket of armature. -- B, axle of wheel and pinions. — C counter axle of reducing cog-wheels. — D, insertion of external pinions which unite in axle F and communicate at F the motion of the rod V. — G insertion of the double central axle communicating the movement to the other tubular rod V<sub>1</sub> by means of the oscillating arm H. The guiding-rods M and N, control the oscillating arms in order to obtain a perfectly vertical and centric movement of the rods; the dotted lines show the radius of action of each oscillating arm when in motion.

gines by the weight of the single rod. The water thus raised flows without interruption and given equal wind velocity, is about twice as much as that obtained with an ordinary single stroke wind engine.

The armature of the machine is placed as usual on the top of the tower, in order to impart the rotatory movement of the sails (see fig. 1, p. 572); the wheel, helm, and the regulator, or automatic device for stop-

ping the engine are of the ordinary type. The axle of the wheel (see fig. 2, p. 573), rests on 2 supports and carries 2 pinions geared with the two cog-wheels that reduce and transmit the movement. The simultaneous and inverse movement of the 2 concentric axles is obtained by 2 rods meeting at an angle of  $180^\circ$ . The external rods work on 2 arms at the end of the axle of the cog-wheels and the central rod is attached to an eccentric axle connecting the 2 cog-wheels; the 2 rods have the same stroke, but in opposite directions.

F. D.

483 - **A Chest of the Funke Type, to be used in Testing Milk.** — WEISDEMANN, in *Deutsche Landw. Presse*, No. 33, p. 355, Berlin, April 27, 1921.

The author gives a description of a case containing all the apparatus necessary, including the separator, for making a rapid test of milk. The case measures  $54 \times 54 \times 36$  cm. and weighs 40 kg. The author has found this device very practical in use.

G. B.

484 - **A Mercury Vapour Current Transformer for use in the country.** — SIMON E., in *Deutsche Landw. Presse*, No. 17, p. 123, Berlin, March 2, 1921.

This apparatus transforms an alternating current into a continuous current. It is especially useful for owners of a continuous current electric plant who have the opportunity of connection with a central station having an alternating current. With the help of this apparatus, there is no necessity for change in the original installation. The author mentions several ways in which this current redresser can be used, and describes the cases where it can be employed with advantage.

G. B.

## RURAL ECONOMICS

485 - **Farm Organisation in Bohemia.** - BRDLÍK (Director of the Institute of Agricultural Accountancy), in *Bulletin du Ministère de l'Agriculture de la République Tchécoslovaque*, Year II, No. 4, pp. 25-27. Prague, Oct. 1 1921.

The Prague Board of Agriculture ("Conseil d'agriculture de Prague") in 1912 founded an Institute of Agricultural Accountancy whose duty it was to control, by means of accountancy, the farms with which it was associated. The farmer correspondents of the Institute supply their weekly reports on income and expenditure, fodder rations for the different domestic animals, and work done in the fields and on the farms. With these data as a basis, the Institute draws up the annual balance-sheet of the farm, which shows how it has been managed during the period. Since its foundation, i. e. in the course of 9 years, the Institute has compiled valuable information regarding the organisation of farms, details of income and expenditure of the landowners, etc.

The trend of farm organisation among the different types of farmers is shown in Table I, which gives the percentages of the various crops cultivated for each type and size of farm:

The figures in Table I do not allow a judgment as to the influence of the size of farms on the percentage of the various crops grown. Those of Table II are more interesting.

TABLE I. — *Percentages of the various crops cultivated.*

	Size of farms			
	2-5 ha	5-20 ha	20-100 ha	100 ha
	%	%	%	%
<i>Arable land:</i>				
1) In the beet growing district . . . . .	91	89	90	93
2) " " cereal . . . . .	85	81	80	80
3) " " potato . . . . .	79	79	80	84
4) " " forage . . . . .	61	77	71	77
<i>Garden:</i>				
1) Do. . . . .	5.4	2.1	3.5	2.3
2) Do. . . . .	4	1.9	1.7	1.1
3) Do. . . . .	2.4	2	1.3	1
4) Do. . . . .	1.9	0.9	0.6	0.3
<i>Meadow:</i>				
1) Do. . . . .	3	8	5	3
2) Do. . . . .	9	16	17	13
3) Do. . . . .	17	16	16	13
4) Do. . . . .	35	17	22	19
<i>Pasture:</i>				
1) Do. . . . .	0.3	0.7	0.8	2.2
2) Do. . . . .	1.7	1.6	1	5.9
3) Do. . . . .	1.7	2.8	2.3	1.7
4) Do. . . . .	2.1	5.9	6.5	4

The area sown with cereals, especially rye and oats, decreases with the increase of the root-growing areas (especially those of the sugar-beet).

TABLE II. — *Percentages of the various crops cultivated.*

Crops cultivated	Size of farms			
	2-5 ha	5-20 ha	20-100 ha	100 ha
	%	%	%	%
Cereals and pulse. . . . .	64	65	59	57
Root crops. . . . .	17	15	20	23
Kitchen-garden crops. . . . .	1	1	1.4	1.4
Forage crops. . . . .	18	19	20	19
	100	100	100	100

The part of the sugar-beet growing area which is under intensive cultivation increases surprisingly in comparison with the part under potatoes. In this district, potatoes form 50 % of the root crop in the group of farms of 2-5 ha, 36 % in those of 5-20 ha, 15 % in those of 20 to 100 ha, and 9 % in those of over 100 ha. In large holdings, the area of

TABLE III. — *Percentages of cereals and roots taken separately.*

Cereals	2-5 ha	5-20 ha	20-100 ha	100 ha.
	%	%	%	%
Wheat. . . . .	14	18	20	27
Rye. . . . .	41	35	31	23
Barley. . . . .	14	16	22	28
Oats and pulse. . . . .	31	31	27	22
	100	100	100	100

Root crops	2-5 ha	5-20 ha	20-100 ha	100 ha
	%	%	%	%
Potatoes. . . . .	74	66	44	40
Sugar beet. . . . .	20	22	48	60
Mongels and legumes. . . . .	6	12	8	—
	100	100	100	100

sugar-beet is about double that in smaller estates; the large holdings also produce the largest quantities of cereals (wheat and barley) for the market as shown in Table IV.

It will be seen that the largest farms grow smaller quantities of cereals and larger forage crops.

TABLE IV. — *Production of cereals and pulse.*

	2-5 ha	5-20 ha	20-100 ha	100 ha
	%	%	%	%
Wheat . . . . .	26	26	32	42
Rye . . . . .	35	29	21	13
Barley . . . . .	22	27	35	38
Oats and pulse . . . . .	17	18	12	7
	100	100	100	100

TABLE V. — *Subdivision of crops  
in the district of intensive cultivation of cereals.*

	2-5 ha	5-20 ha	20-100 ha	100 ha
	%	%	%	%
Cereals and pulse . . . . .	68	70	66	65
Root crops. . . . .	15	13	14	12
Kitchen-garden crops. . . . .	0.8	0.1	1.1	0.9
Forage crops . . . . .	16	17	19	22
	100	100	100	100

In the 3rd district, where potatoes are chiefly grown, with the increasing size of farms, the area under cereals decreases and that under forage crops increases; in the large holdings the area under root crops also increases.

TABLE VI. — *Subdivision of crops cultivated in the district where the potato crop is predominant.*

	2-5 ha	5-20 ha	20-100 ha	100 ha.
	%	%	%	%
Cereals and pulse . . . . .	65	62	59	57
Root crops . . . . .	16	16	16	20
Kitchen-garden crops . . . . .	0.9	0.5	1.7	0.8
Forage crops . . . . .	18	21	23	22
	100	100	100	100

The characteristics of the 4th district, where forage crops are chiefly grown, are shown in Table VII:

TABLE VII. — *Subdivision of crops cultivated in the district where forage crops predominate.*

	2-5 ha	5-20 ha	20-100 ha	100 ha.
	%	%	%	%
Cereals and pulse . . . . .	57	67	71	69
Root crops . . . . .	11	12	8	6
Kitchen-garden crops . . . . .	5.6	1.3	0.8	0
Forage crops . . . . .	26	20	20	25
	100	100	100	100

It will be seen therefore that on the largest estates the area under cereals increases considerably, while that under root crops and legumes decreases.

The author has also studied the influence of the size of farms on the number of draught and other animals. By estimating the work of oxen and cows on the same scale as the work of horses, using the coefficient 2 horses = 3 oxen = 5 cows, the data set out in Table VIII are obtained.

It will be seen that the need of draught-animals decreases with the increased size of farms and that large holdings make a greater profit from the work of draught-animals than small. Draught animals reduce the stores of forage which could be utilised in dairy-farming, meat production, etc., by other kinds of cattle.

Hence the table shows that the number of cattle decreases with the increased area of farms, and that this is especially the case with milch-cows and young cattle; the medium-sized farms are engaged chiefly in the rearing of young cattle.

TABLE VIII. — *Number of draught animals used on 100 ha of arable land.*

	Farms of 2 to 5 ha		Farms of 5 to 20 ha		Farms of 20 to 100 ha		Farms of more than 100 ha	
	Number of head	Work reduced to horse power	Number of head	Work reduced to horse power	Number of head	Work reduced to horse power	Number of head	Work reduced to horse power
Horses . .	2	2	9.4	9.4	9.8	9.8	4	4
Oxen . . .	4.2	2.8	8	5.3	8.8	5.8	12.6	8.4
Cows . . .	60	24	13.6	5.4	—	—	—	—
Total . .	—	28.8	—	20.1	—	15.6	—	12.4

TABLE IX. — *Live weight in kilograms of horned cattle not utilisable for work. Average per hectare of arable land.*

	2-5 ha	5-20 ha	20-100 ha	1000 ha
	kg.	kg.	kg.	kg.
1st district . . . . .	449	304	225	123
2nd district . . . . .	458	294	209	153
3rd district . . . . .	402	264	217	183
4th district . . . . .	572	272	236	153
Average . . . . .	446	285	218	145

TABLE X. — *Live weight in kilograms of cattle per hectare of arable land.*

	2-5 ha	5-20 ha	20-100 ha	100 ha
	kg.	kg.	kg.	kg.
Young cattle . . . . .	109	88	67	32
Fat cattle. . . . .	—	—	24	40
Cows . . . . .	287	164	109	67
Total . . . . .	396	252	200	139

TABLE XI. — *Live weight in kilograms of swine per hectare of arable land.*

	2-5 ha	5-20 ha	20-100 ha	100 ha
	kg.	kg.	kg.	kg.
1st district . . . . .	52	30	8	0.4
2nd district . . . . .	41	27	12	2.4
3rd district . . . . .	25	20	15	3
4th district . . . . .	14	13	17	4
Average . . . . .	37	24	12	1.8



Thus the larger the farm, the smaller the number of swine.

As for sheep and goats, it has been proved that sheep have a relative importance on medium-sized farms only and that goats are not found on large holdings.

TABLE XII. — *Live weight in kilograms of sheep and goats per hectare of arable land.*

	2-5 ha	5-20 ha	20-100 ha	100 ha
	kg.	kg.	kg.	kg.
Sheep . . . . .	—	1.1	3.3	2.9
Goats . . . . .	2.7	1.1	0.1	—

Poultry also decrease with increased area of farms as is seen in Table XIII.

TABLE XIII. — *Live weight in kilograms of poultry per hectare of arable land.*

	2-5 ha	5-20 ha	20-100 ha	100 ha
	kg.	kg.	kg.	kg.
Fowls. . . . .	5.6	3.5	1.8	0.2
Other kinds. . . . .	4.1	3	1.3	0.1
Total . . . . .	9.7	6.5	3.1	0.3

It is certain that these proportions between the different classes of domestic animals have an influence on the utilisation of fertilisers and forage, and consequently on vegetable and animal production.

C, A. B.

486 — **Evaluation of the Risk in Agricultural Enterprises and Assurance of Crops against Adverse Weather Conditions in the United States of America.** — See No. 370 of this *Review*.

487 — **Cost of Rice Production in the Philippines** — See No. 400 of this *Review*.

488 — **Notes on Coffee Growing in Brazil.** — See No. 426 of this *Review*.

489 — **Cost of Colt Breeding up to three Years in the United States.** — See No. 452 of this *Review*.

490 — **Cost of Milk Production in some of the States of North America** (1). — I COMBS S. and BAIN, J. B., A Study of the Factors involved in producing Milk in North Carolina, in *North Carolina Department of Agriculture Bulletin*, vol 41, No 5, pp. 30, figs 2 Raleigh, 1920 — II. BAIN J. B., and POSSON R. J., Requirements and Cost of producing Market Milk in Northwestern Indiana, in *United States Department of Agriculture, Bulletin* No 858, pp 31 figs 8 Washington, 1920 — III BAIN J. B., and BRAUN G. H., Unit Requirement for Producing Milk in Western Washington, *Ib. Bulletin* No 919, pp 19, 1920. — IV. BAIN J. B., and POSSON R. J., Unit Requirements for producing Market Milk in Vermont, *Ib. Bulletin*, No 923, pp 18 tabl 12, fig 2, 1921 — V BAIN J. B., BRAUN G. and WOOD W. D., Unit Requirements for producing Market Milk in Southeastern Louisiana, *Ib. Bulletin* No 955, 1921

I. — A study of the factors involved in the cost of producing milk for direct consumption in the small towns of the counties of Guilford and Forsyth. This study has been undertaken by the experimental agricultural station of North Carolina, in collaboration with the Dairy Division of the United States Department of Agriculture. The enquiry was begun in August, 1915, and lasted 2 years. During the first year, 13 farms were visited monthly, and in the second, 14; the annual production and the factors involved in the cost of production from 557 cows were registered during this period. The average production per cow was 2223 kg. of milk for the 1st year and 2233 kg. for the 2nd. The cost of forage and pasture was 54.8 % of the total cost of the milk production; wages amounted to 28.6 % and sundry expenses (including litter) to 16.6 %. The total cost of production does not include the farmer's remuneration; and this applies also to the 4 following items

In winter, 50.3 %, and in summer, 46.7 %, of the labour employed on the farm was devoted to milk production; the rest was employed in the refrigerating, bottling and transport of the milk to the consumer. About 18 % of the work was done by women and children, both in winter and in summer.

II. — The Agricultural Extension Service of the Purdue University, in collaboration with the Dairy Division, ascertained the cost of producing milk intended for the Chicago market, for a period of 2 years, beginning the 15th August, 1915, in the county of Porter (Indiana)

In 1915-1916 this Service registered the yield of 334 cows belonging to 16 herds; the average yield was 3119 kg. per head per year. The following year the yield of 404 cows from 21 herds was registered; the result being an average of 3169 kg. of milk per head, per year. The average percentage of fatty matter was 3.7. About the same proportion of cows were not in milk (12-13 %) both in summer and in winter. Births were almost equally distributed over the summer and winter seasons, being 87 per year per 100 cows.

(1) These works form part of a series of studies, all on the same plan for typical districts of several of the States of North America. The most important results of the first 4 were taken from another source and summarised in *R* July 1921, No 759, the article analysed contains other interesting data, which are completed by those of the above-mentioned summary — See also *R* Jan 1920, No 115 (*Fd*)

In the annual average the total cost of milk production was distributed as follows: forage 49.4 %; pasture 8.2 %; labour 19.5 %; sundry expenses 21.6 %; depreciation of cows 1.3 %. The calves were credited with 6.8 % of the total cost of the milk production as increased by the depreciation of the cows, and manure with 15.5 %. In winter, 80 % of the labour was employed in milk-production, and in summer, 75.5 %; the rest was used in handling and transport. Women and children performed 15 % of the total labour in winter and more than 19 % in summer.

III. — A study of the cost of milk production and the factors involved in the county of Skagit, about 70 miles north of Seattle (Washington State).

In the 1st year, the enquiry began in August, 1917, and covered 17 herds. In the 2nd year, it began in January 1919, and covered 18 herds. Each herd contained an average of 31.3 cows in 1917-1918 and 28.6 cows in 1919. In the general average for the 2 years, there was a yield of 3598 kg. of milk, with 3.66 % of fatty matter, per head per year. The majority of the cows were of the Holstein breed. Almost all the milk was sold to the condensing establishments, to which it was transported in motor lorries.

In winter, 115 kg. of manure per 100 kg. of milk produced were taken up in the stable; during the summer, when the cows were pastured during the day 13 kg. only per 100 kg. of milk were obtained; 3 % of the cows did not calve during the year, 55 % calved during the winter season and 42 % during the summer. The total expenditure (including depreciation of the cows) was distributed as follows: forage and litter 43.9 %; pasture 12.5 %; labour 23.5 %; sundry expenses 17.6 %. The depreciation of the herd was estimated at 2.5 % of the total expenses, and 4.4 % of the total value of the head of cattle.

Paid labour (chiefly that of professional milkers) was employed for 64.2 % of the work in winter and 59.2 % in summer. Women and children performed 10.2 % of the winter work and 13.8 % of the summer work.

For the keep of a bull for 1 year, 286 kg. of concentrated food; 2707 kg. of dry forage; 1392 kg. of fresh forage; 20 kg. of litter; 40.4 hours of labour, plus pasture and sundry items (buildings, implements, taxes, interest on capital invested in stock, veterinary expenses, drugs, disinfectants, etc.), were required.

IV. — A study on the cost of milk production in the county of Addison (Vermont) made in 1917-1918. The data were taken for the 1st year from 17 herds, containing on an average 26.1 cows, and for the 2nd year from 18 herds, containing an average of 22.4 cows. The cows were chiefly of the Holstein breed; the average annual yield of milk was 2382 kg. per head. The milk was conveyed to the central collecting stations, whence it was sent to New York for direct consumption. 41 quintals of manure per cow were taken up from the stable in winter, and 7 in summer; 15 % of the cows did not calve during the year; 27 % calved

during the period from 1st May to 31st October and 58 % during the rest of the year; the majority calved in the spring.

Forage and litter accounted for 49.4 % of the total cost of production (including the depreciation of the cows); pasture 5.5 %; labour 21 %; and other expenses 20.7 %. The depreciation of the herd was 3.4 % of the total cost. Manure was set off against 17.7 % of the total expenses, and calves against 5.5 %.

During the winter, 41.7 % of the work was carried out by the owners; 47 % was paid labour; and 11.3 % was done by women and children. In summer the corresponding percentages were 39.1; 42.4; 18.5. In winter, 79.9 % of the work consisted in production, properly so called, as distinct from handling and transport; in summer, 77.6 %.

For the annual maintenance of a bull, 152 kg. of concentrated food; 3044 kg. of dry forage; 1087 kg. of fresh forage; 122 kg. of litter and 37.7 hours of human labour plus the cost of pasture and sundry items, were required.

V. — A study of the factors involved in the cost of milk production in the parish of Tangipahoa (Louisiana) during the 2 years beginning with March, 1918. The data were taken from 14 farms during the whole period of 2 years, and from 8 others for 1 year; they amounted to 892.6 years of production or lactation, yielding, on general average, 1409 kg. of milk, which is sent to New Orleans for direct consumption. The Table given below shows the averages for the 2 years under consideration.

*Sundry expenses and quantities of food and work required for milk-production in the parish of Tangipahoa, Louisiana.*

	Concentrated food purchased	Grain produced on the farm	Leguminous hay	Other hay	Straw and stalks	Pressed green and other fodders	Manual labour	Horse labour	Litter	Pasture	Sundry expenses (1)
	kg.	kg.	kg.	kg.	kg.	kg.	hours	hours	kg.	dollars	dollars
<i>Per cow:</i>											
From Oct. to March	420	10	35	91	84	465	75.3	11.6	1.8	2.03	13.05
From April to Sept.	426	2	4	4	8	66	82.2	12.1	—	3.55	11.74
For the whole year	846	12	39	95	92	531	164.5	23.7	1.8	5.58	24.79
<i>Per 100 kg. of milk:</i>											
From Oct. to March	70.8	1.6	9.0	15.2	14.1	78.4	11.0	2.0	0.3	0.344	2.20
From April to Sept.	50.2	0.3	0.5	0.5	0.9	8.1	11.0	1.5	—	0.453	1.44

(1) Variations in the inventory value not included.

7820 kg. of manure per cow were taken up in winter and 626 kg. in summer. About 43 % of the cows calved in winter and 42 % in summer.

The forage and litter represented altogether 49.3 % of the total cost of production (including the depreciation of the cows); pasture represent-

ed 4.1 %; labour 24.2 %; other expenses 4.2 %. Manure was set off against 5.5 % of the total cost of production, and calves against 1.7 % (there having been little demand for calves on the market, this credit is rather high).

During the winter, 33.1 % of the work was done by the owners; 41.9 % was paid labour; 25 % was carried out by women and children. During the summer the corresponding percentages were: 28.2; 42.7; 29.1.

For the annual maintenance of a bull, 544 kg. of concentrated food; 353 kg. of dry forage; 511 kg. of fresh forage; 0.9 kg. of litter; 33.6 hours of manual labour, besides pasture and sundry items, were required.

F. D.

## AGRICULTURAL INDUSTRIES

491 - **Modern Processes of Wine Making Technique.** — SANNINO T. A., in *Rivista di Ampelografia*, year II, No. 10, pp. 141-152 Leghorn, October 1, 1921.

INDUSTRIES  
DEPENDENT  
UPON  
VEGETABLE  
PRODUCTS

The report made to the Brescia National Congress of Wine-Growing (Italy), September 5-6-7, 1921.

WINE-MAKING WITH SULPHUR DIOXIDE (1). — Until quite recently, sulphur dioxide was used only in cellars for the preservation of wine that had already been made, except in the case of sweet wines. It is now, however, employed in wine-making, 10-20 gm. of potassium bisulphite being added per quintal of grapes in temperate climates at the moment of pressing, and as much as 30 gm. in hot climates when the alcoholic fermentation has reached its maximum.

This insures the action of good quality alcoholic ferments and the scent and flavour of the wine is improved; it is more highly coloured, if red grapes are used, and of a finer straw-colour if white ones are employed; in both cases the wine is clearer and keeps better. A great part of the sulphur-dioxide introduced is eliminated during the violent fermentation and hence no bad effects are produced.

The introduction of sulphur dioxide is specially advantageous when the grapes are of poor quality; it should not be used for good grapes grown on the slopes, especially if the wine is to be matured as maturation is hindered by its presence.

In hot climates the addition of sulphur dioxide induces complete fermentation, and replaces plastering, as practised in Sicily, and correction with tartaric acid as is customary in Apulia.

The author gives an account of research in the use of sulphur dioxide in wine-making, and refers to the works of P. CZEPPÉL (1888). Head of the Wine Vaults of the "R. Scuola Enologica di Catania", of Prof. U. RICCIARDELLI (of the "R. Cantina sperimentale di Riposto"), of MENSIO and PARIS in Italy, and of MARTINAND, ROOS, SEMICHON, ASTRUC, and VENTRE, in France.

(1) See *R. Nov.* 1917, No. 1061. (Ed.)

The introduction of sulphur dioxide facilitates the use of selected ferments.

Certain "associated" products are found on the market, such as JACQUEMIN bisulphite, and HUBERT sulphophosphate; these are mixtures of two substances, one of which liberates sulphur dioxide, while the other provides food-material, such as ammonium phosphate, for the alcoholic ferments.

The addition of sulphur dioxide at the time of manufacture increases the keeping capacity of the wines but does not protect them against "la fleur", or prevent their turning acid in the barrel when sold retail; the only remedy in both these cases is the introduction of carbon dioxide.

UNFERMENTED GRAPE PRODUCTS. — Fermentation is entirely prevented by adding to unfermented must 70 gm. of sulphur dioxide per hectolitre. If such must is poured into a concentrating apparatus, and distilled in a vacuum, the sulphur dioxide is first removed, and then the water, the resulting product being a concentrated must that can be used for many purposes.

The author mentions the BARBET apparatus which obviates the need of large plants, and the FUDO MONTI apparatus (1) in which concentration is obtained by lowering the temperature.

THE RAPID PRODUCTION OF SPARKLING AND THE QUICK MATURATION OF OTHER WINES (2), — The wine is pasteurised if necessary, or else heated to the best temperature for insuring rapid fermentation. The required amount of sugar and of selected ferments are added, and the wine is allowed to flow into large, closed vessels of enamelled iron. After ten days, the pressure of 6 atmospheres is reached, and then the wine passes automatically, and without any loss of carbon dioxide, into other enamelled or silver-plated receptacles. By means of the refrigerator it is cooled down to some degrees below zero to keep it as clear as possible. Sparkling wine is filtered without loss of gas, and when quite clear, passes into another vessel and thence into bottles, still retaining its gas. In Italy there are some CHARMAT plants already at work. This method can also be used in the preparation of sparkling Muscat which is more difficult to make than champagne.

The CHARMAT process for maturing wines is based on the use of high and low temperatures. The wine is pasteurised in an œnotherm, under pressure and in the presence of air, in order to allow the bouquet to develop; it is then cooled for a time at some degrees below zero and finally filtered and bottled.

MONTI devised a rapid maturing process which consists in passing a current of air through wine cooled at 2-4 degrees below zero, but this method does not suit all kinds and cannot for instance be employed in the case of Marsala, as it destroys the characteristic bouquet.

(1) See R. 1914, No. 946; R. 1917, No. 857; R. 1920, Nos. 249 and 909. (Ed.)

(2) See R. Oct., 1921, No. 1042; R. July 1921, No. 756. (Ed.)

The author is of opinion, that the adoption of the CHARMAT and MONTE processes will greatly stimulated the progress of the already extensive Italian wine-industry.

F. D.

492 - **Experiments in Fermenting Kaki Fruits.** — MANZONI I. (R. Scuola di Viticoltura ed Enologia, Conegliano), in *Le Stazioni sperimentali agrarie italiane*, Vol. LIV, Parts 7-10, pp. 284-288 Modena, 1921.

The kaki has the advantage of being very hardy; it is not an exacting plant and produces a heavy, regular crop. One hectare can bear 350 trees, each yielding 1 quintal of fruit. As the fruit can only be directly consumed to a limited extent, and when perfectly ripe is very rich in sugar, the author tried to find out whether it could be made useful by fermentation.

Kaki fruits gave on analysis 16 % of reducing sugar but only 0.4 per 1000 total acidity, hence the author in order to obtain satisfactory fermentation made the following additions:

1) bi-tartrate of potassium 5.5 per 1000 + tartaric acid 1 per 1000 + citric acid 1 per 1000. In this manner, a total acidity of 4.4 per 1000 was obtained expressed as tartaric acid.

2) one quart of sterilised white grape must (with 22 % of sugar and 12 per 1000 acidity) + bi-tartrate of potassium 5 per 1000 + tartaric acid 1 per 1000 thus making a total acidity of 3 per 1000 expressed as tartaric acid. In both cases, the selected wine-making ferments were added and fermentation took place at 22° C.

The process began with a clearly marked separation of the liquid part and the spongy layer above it. On the fourth day, while fermentation was still active, the mixture was passed through a cloth, 74 % of liquid being thus obtained; a yield of 80 % of must could therefore be expected if industrial presses were employed. The must was then allowed to ferment slowly and was cleared with tannin and gelatine.

The results of the analyses made when fermentation was complete were as follows:

1) Wine from kaki fruits alone: alcohol 8.9 %; dry extract 22.42 per 1000; acidity 4.7 per 1000; ash 2.64 per 1000.

2) Kaki wine with  $\frac{1}{4}$  grape must: alcohol 9.5 %; acidity 4.12 per 1000; slightly sweet.

The wine remained sound and clear. When tasted, the first was clear and of a pale straw colour tending to greenish. It had an alcoholic scent mixed with an almost aromatic fruit bouquet, a slightly acid, dry, rather bitter taste which was flat and not vinous. The second, made with the addition of grape must was very clear, of a light golden-yellow colour, and with peculiar scent of flowers. It had a pleasant sweetish, slightly acid flavour which was stronger and cleaner than that of the wine made from kaki fruit alone. It had in fact the taste of a good cider without any of its disagreeable qualities.

"Wine" made from kaki fruit without any admixture of grape must yielded a good vinegar with 4.89 % total acidity. A 45° brandy was

obtained from the "wine" by distillation with a scent resembling that of an ordinary pomace brandy and tasting like cider brandy.

These results show that it is technically possible to make good cider by the addition of grapes or other fruits to kakis, or to obtain a satisfactory product by the distillation of "wine" made from kaki fruits alone. It is an interesting fact that the kaki tree is much less difficult to grow than the cider apple-tree and yields a larger crop per acre. F. D.

493 - **The Raw Materials used in the Italian Alcohol Industry.** — Sessa L., in *Giornale di chimica industriale ed applicata*, Year III, No. 12, pp. 563-564. Milan, December 1921.

The following Table gives the number of *hectanhydres* of the various kinds of alcohol made in Italy from 1906-1907 to 1919-20 from different raw materials. The figures refer in each case to the fiscal year dating from July 1 to June 30, and have been taken from the statistics of the taxes on alcohol manufacture published by the Italian Ministry of Finance.

An examination of this Table brings out the dominant feature in the Italian alcohol industry, viz., the great variation from one year to another in the raw material used which admits of a very simple explanation. Alcohol can be manufactured from virous matter or from substances containing starch or sugar; there is thus a wide field of selection, and cereals, beets or wine are employed according to the condition of the markets. The raw materials for the manufacture of alcohol may be divided into 2 categories.

*Essential materials*, viz., those that can be used for no other purpose such as spoilt cereals, pomace of various kinds, wines that have gone sour, surplus wine in years of over production, molasses etc.

*Optional materials* viz. those only occasionally used for making alcohol when the conditions of the market permit, such as sound cereals, beets, fruits etc.

Naturally it is the former class that first supply the alcohol market and sometimes even over-stock it. The production of molasses alcohol keeps pace with the development of the sugar industry; immense quantities of wine alcohol are available in years of superfluous wine-production such as 1907-1908-1909 while the amount of pomace alcohol remains constant and is in correlation with the vintage season.

The consumption of alcohol in Italy during the pre-War years reached a maximum of 350 000 *hectanhydres*.

The optional materials are used to a limited extent only, according to cost, thus cereal and beetroot alcohols are employed alternatively to make up the annual deficit.

Under the head of various substances are included fruit in general (dried fig, dates, carobs etc.). They are not much used as a rule, but were sent to the distilleries in considerable quantities during the War and in the years immediately following, when the alcohol market underwent a serious crisis owing to the absolute dearth of raw materials and the abnormal stocks of these fruits in hand due to the prohibition of all export-



*Alcohol Production in Italy, in Hectanhydres.*

Raw materials	1906-07	1907-08	1908-09	1909-10	1910-11	1911-12	1912-13
Cereals . . . . .	81 660	57 539	32 411	12 527	64 934	59 865	112 143
Molasses . . . . .	98 841	85 739	119 990	106 866	158 236	130 742	147 801
Beetroots . . . . .	13 785	11 598	13 468	8 554	8 858	9 653	22 941
Dried grapes. . . . .	5 985	83 271	3 076	1 949	26	148	—
Pomace . . . . .	72 162	106 922	128 833	100 341	46 698	57 847	62 340
Wine . . . . .	2 912	115 869	501 314	188 261	16 446	1 251	2 941
Various substances . .	2 089	2 439	1 445	423	1 479	1 126	964
<b>Totals . . .</b>	<b>217 434</b>	<b>463 377</b>	<b>800 537</b>	<b>418 921</b>	<b>296 667</b>	<b>260 632</b>	<b>349 131</b>
Raw materials	1913-14	1914-15	1915-16	1916-17	1917-18	1918-19	1919-20
Cereals . . . . .	56 137	12 999	45 007	33 202	8 678	11 374	79 398
Molasses . . . . .	185 530	188 070	167 737	139 241	117 063	167 049	18 359
Beetroots . . . . .	31 075	13 214	17 870	103 279	116 105	4 675	10 262
Dried grapes. . . . .	—	—	—	—	—	—	—
Pomace . . . . .	82 061	72 622	24 051	34 245	49 578	40 175	36 072
Wine . . . . .	10 281	10 848	859	335	3 418	8 415	2 243
Various substances . .	499	209	6 992	4 692	5 069	6 809	15 635
<b>Totals . . .</b>	<b>371 583</b>	<b>297 962</b>	<b>262 516</b>	<b>314 994</b>	<b>299 211</b>	<b>238 497</b>	<b>331 969</b>

tation. Under ordinary circumstances fruit and carobs can be more advantageously used, and they are only sent to the distillery when the price of alcohol is very high *c. g.* 900 lire per *hectanhydre*, exclusive of tax.

With free competition, the price of alcohol is fixed by the cost of the best raw material available in unlimited quantities. To avoid over-production, the price of alcohol made from the first class of materials must be regulated by this price and always kept below it. Normally the price of alcohol depends upon the price of maize, which can be obtained in great quantities and is highly estimated throughout the world. Sometimes, however, the price is governed by the cost of beetroots, but to a less extent, the beet being a seasonal product.

G. A. B.

494 - **Experimentation in Milling and Baking of "Adlay" (*Coix Lacryma Jobi* var. *mayuen*).** — See No. 412 of this *Review*

495 - **Oil from the Pips of French Grapes.** — DE FAYARD, J., in *Revue de Viticulture* Year 28, Vol. V, No. 1635, pp. 480-487. Paris, December 29, 1921.

From the various analyses of grape pips made by the author at Charente, the following oil-content percentages were obtained: Folle Blanche 10 to 12.50 — Saint Émilion 9 to 11.3 — Colombard 10.5 to 12. The amount of oil present would seem to be correlated with the ripeness of the grapes.

The physical and chemical constants of the 2 samples of oil prepared by the author by extraction with carbon tetrachloride were as follows:

	I	II
Density at + 15° C	0.933	0.926
Solidification point	- 11	- 12
Saponification index	182	178
MAUMENÉ test	56	53
Iodine index	96	91
REICHERT MEISSL index	0.46	0.39
HOFMANN index	94.5	9.0

I. P.

496 - The Utilisation of the Residues of Oil Extraction from Olives (1). - DR MANJARRÉS, R., in *La Revista Vinculada de Agricultura* N.º 4 pp. 31-40. Zaragoza February 16, 1922.

More than 2 years ago, the author in collaboration with Count DE CASA CHAVES, Director of the Regional Mineralogical Museum of Cordova, started research work upon the systematic utilisation of the residues from olive-oil factories. When it is realised that the oil industry in Spain produces an average of 200 000 tons of exhausted pomace and that owing to the scarcity of forests the products of wood distillation find a ready sale, it can readily be understood that the distillation of this residue may be very profitable.

Distillation can be carried out in closed vessels differing considerably from those usually employed, for the pomace can be closely piled so as to leave no space for the free escape of the volatile substances. According to the authors' experiments from one ton of pomace may be obtained 200 kg of charcoal in practically powder form and 160 cub. m. of complex and very combustible gases. The condensed liquids consist of acetic acid, alcohol and ammonia. The acetic acid is separated with milk of lime, as in the distillation of wood. For the separation of the alcohol from the ammonia, superphosphate of lime must be used, by this means a phospho-ammoniacal fertiliser is obtained and the alcohol is liberated.

One ton of pomace gives 40 kg acetic acid, 80 kg of tar and 17 litres of methyl alcohol. The charcoal and gases supply fuel for the distilling apparatus. In large factories briquettes can also be made of the tar and charcoal dust. The ashes form a fertiliser for the olive-trees.

The blackish, turbid liquid deposited at the bottom of the vessel under oil-presses is called *caux d'enfer*, and is of very variable composition according to the oil-factory. The amount produced in Andalusia may be estimated at 300 000 tons.

From one ton may be obtained 15 litres of rectified ethyl alcohol, 3 kg ammonium sulphate and a small variable quantity of an innocuous, red, colouring substance that can be used for the coloration of syrups, liqueurs etc. The *caux d'enfer* must be subjected at once to alcoholic

(1) See R. Dec. 1915 No. 125; April 1916 No. 115 (Id.)

fermentation ; from the distillation residue other substances can be obtained by the ordinary processes

On evaporation the resulting liquid, deposits potassic salts, and if the semi-fluid residue is subjected to distillation, charcoal and gases are obtained, but it should be noted, that during the process the residue increases in volume, and the vessels used must therefore be of a special shape

The process is remunerative provided that 1) large amounts of material are used, 2) the residues are utilised for fuel, 3) all the escaping heat is turned to account, 3) economical evaporators are employed

P C

497 - **Economic Value of Sunflower Oil : Tests made in Great Britain.** - See No 431 of this Review

498 - **Variations in the Percentage of Fat in Successive Samples of Cows Milk** (1). - RAGSDALE A C, BRODY S and FERNER, C W in *Journal of Dairy Science*, Vol X, No 5 pp 448-450 Baltimore, September 1927

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The fact that successive samples of milk drawn from a cow gradually increase in fat content, has long been known and was formerly explained by supposing that the fat being lighter rose to the top of the milk cistern and ducts

This gravity theory was however discarded as a result of the observations of HEDENHAIN, who found that the difference in the volume of the udder before and after the evacuation of milk is much below the volume of milk given by a cow during one milking, and consequently inferred that a large part of the milk is secreted during the process of milking. The authors describe their own experience which may contribute to an explanation of the phenomenon. The right front quarter of a Jersey cow producing about 20 pounds of milk per day was milked under the following conditions

*Amount of Fat in Successive Fractions of Milk*

Sample No	Cow			Cylinder	
	Upon coming into barn	After standing - hours	Standing - hours and manipulation	After standing 1 1/2 hours	After standing 3 hours
1	31 %	14 %	63 %	44 %	16 %
2	32	15	61	54	27
3	47	19	64	57	36
4	54	30	65	58	42
5	59	34	65	59	49
6	66	41	68	60	54
7	69	48	72	60	59
8	65	78	75	63	68
9	68	110 (about)	82	67	120

(1) See *R* June 1920, No 670 (1d)

1) immediately on coming into the barn from the pasture, 2) after standing quietly in the barn for two hours, 3) after standing in the barn for two hours followed by a thorough massaging and manipulation of the udder for a few minutes for the purpose of "mixing" the milk withur, if possible. The milk in each case was milked into a 100 cc cylinder and fat determined in each of the 100 cc fractions. For comparison determinations were made on the variations of fat in successive 100 cc of milk drawn from a 900 cc cylinder of the usual dimensions after standing respectively for 1 ½ and 3 hours. The results given in the Table show that, within given limits, the longer the cow stands quietly the greater the variation in the fat content of the successive fractions of the milk. The curves of variation in the cylinder and udder are strikingly similar.

F D

**499 - Brown Glass Milk Bottles and their Use in preventing Milk from Acquiring abnormal Flavour and Odours due to the Action of Light.**

HAMMER B W  
and CORDES W A in *Advance Sheet of Research Bulletin of Iowa Agricultural College*  
summarised in *The Creamery and Milk Plant Monthly* Vol X No 6 pp 324  
Chicago, 1911

The authors have made a comparative study of the effect produced upon the colour, flavour and bacterial content of milk by placing it in white and in coloured bottles respectively. The results proved that sunlight produces abnormal flavours in milk and cream, whence the necessity of keeping bottles of milk, even in winter in a special covered chest or under a blanket.

Though brown milk bottles prevent these changes, their use cannot be advocated, because they make it difficult to see the sediment or the cream line, thus preventing whole milk being distinguished from milk that has been more or less skimmed. Milk kept in brown bottles has also a higher bacterial content than milk in ordinary bottles, which is in part due to the higher temperature of the brown bottles and also to the fact that light has a decided influence in keeping down the number of bacteria in white bottles. In fact if part of the same milking is exposed to sunlight in ordinary bottles and the rest kept in the dark in similar bottles, it will be found that the bacterial content is lower in the exposed milk, although the temperature is higher.

From the general results of their observations, the authors have drawn the following conclusions:

Sunlight has a pronounced influence on the flavour of milk and cream, with sufficient exposure a definite tallowy flavour was produced, and with less exposure a distinct sour flavour developed.

Sunlight is observed to produce an abnormal flavour, sometimes tallowy and sometimes otherwise, in other dairy products, such as ice cream, evaporated milk, skim milk and starters. When milk or cream has acquired a tallowy flavour from exposure to light, it is communicated to the butter which does not lose it by keeping.

When there was an increase in acidity in milk exposed in ordinary bottles and brown, the increase was generally greater in the brown bottles.

The colour of milk exposed to sunlight does not alter nearly as much in brown as in colourless bottles, in which the milk after a time shews a chalky dead-white appearance and produces butter of much lighter colour. Light has a greater influence on a milk low in fat content than on a milk with a high fat content.

Exposure to air had evidently some influence on the development of a tallow flavour.

The tallowy flavour in milk exposed to sunlight in white bottles apparently decreased somewhat as a result of storage at low temperature.

F. D.

500 - **Influence of Foreign Matter upon the Number of Bacteria in Milk.** — HARDING, H. A., PRUCHA, M. J., KOHMAN, F. F., WLETER, H. M., and CHAMBERS, W. H., in *Journal of Dairy Science*, Vol IV, No 5, pp 430-447 Baltimore, September 1921.

It used to be thought that the absence of foreign matter or dirt had a great influence upon the bacterial count of milk, but the results of recent research tend to show that the cleanliness of milk in this respect is of much less importance than has been supposed. The existing divergence of opinion however encouraged the authors to make an experimental study of the question at Urbana, the Illinois Agricultural Experiment Station.

The results of their investigations have shown that :

Practically all the dirt entering the milk at a farm is introduced during the operation of milking.

The use of a small-topped milk-pail materially reduces (from 20 to 40 %), the amount of impure matter that finds its way into the milk.

The weight of the impurities entering the milk during the milking process is surprisingly small. Even when the cows were extremely dirty and milked into an open-topped pail, the dirt in the unstrained milk amounted to only about 10 mgm. per quart. When the conditions were comparable to those of ordinary dairies and the small-topped pail was used, the dirt in the milk was less than 5 mgm. per quart.

The kinds of impurities which fall into the milk vary with the condition of the coat of the cow. With hand-milking the entrance of some hair and dandruff is practically unavoidable, though the amount may be reduced by regularly brushing the coat of the animal. If flank or udder is soiled with dried manure or other dirt, some may also find its way into the milk.

Thorough straining removes the hair, dandruff, and larger particles which form 75 to 90 % of the visible dirt. Undoubtedly some of the impurities go into solution in the milk, but the amount is so small that the authors did not succeed in measuring or detecting it.

The increase in the bacterial count due to the entrance of dirt into the milk varies widely with the nature of the dirt. Hair and dandruff from clean cows have much less effect than from dirty cows.

On extremely dirty cows there were 1500 million germs per gram of dirt. Under the worst conditions when the dirt in the milk amounted

to 10.8 mgm. per quart, the increase in the number of bacteria was about 17 000 per cubic centimetre. Under similar conditions, except that a small-topped pail was used, which reduced the dirt to 8.1 mgm. per quart, the bacterial count due to dirt fell to 13 000 per cubic centimetre.

The use in warm weather of clean utensils which have not been promptly and thoroughly dried results in the immediate increase of the germ count of the milk varying from 30 000 to 1 000 000 per cubic centimetre.

In summer milk drawn in the morning and delivered from the farm to the milk plant has an average bacterial count of at least 50 000 per cubic centimetre. After the first 6 to 10 hours, the growth of the microorganisms begins and their number may rapidly increase.

In view of these facts it is clear that the variations due to dirt which occur in the bacterial count, and may be as large as 17 000 per cubic centimetre, will be less important than other factors at any rate in summer.

When the time interval permits growth, it is impossible to judge, on a basis of bacterial count, the conditions of cleanliness in the production of a given sample of milk.

An examination of milk based on the germ count does not therefore protect the consumer. In order to prevent the sale of milk contaminated by impurities it is necessary to determine the impurities actually present by measuring the sediment formed, or by filtering the milk through cotton and weighing the filter before and after filtering and drying. By this method the data obtained are a little higher than they are in reality.

F. D.

501 - Type of Lactic Acid produced by Starters and by the Organisms isolated from them. — HAMMER, B. W., in *Advance Sheet of Research Bulletin 56, Iowa Agricultural Experimental Station and the Creamery and Milk Plant Monthly*, Vol. X, Part 8, p. 24 Chicago, 1921

Recent work has shown that starters are not pure cultures of *Streptococcus lacticus* as is commonly supposed. HAMMER and BAILEY showed that pure cultures of the *Streptococcus* do not produce a volatile acidity at all comparable with that obtained by a good starter and that starters generally contain an associated organism which when grown in combination with *S. lacticus*, yields a volatile acidity essentially the same as that produced by a satisfactory starter. STORCH found that organisms, which he calls  $\alpha$  bacteria, are present in starters and that these play a part in the production of a good cheese. BOCKHOUT and OTT DE VRIES reported the isolation from starters of organisms that in combination with lactic acid bacteria produce the characteristic aroma.

It can be proved that starters are not pure cultures of *S. lacticus*, by ascertaining the type of lactic acid found in a starter and comparing it with the type produced in milk by pure cultures of *S. lacticus*.

This method was adopted by the author, who also determined the type of lactic acid produced when the associated organisms are combined with *S. lacticus*.

It has been shown by the work of a number of investigators (HEINEMANN, SUZUKI, HASTINGS and HART, ORLA JENSEN), that *S. lacticus* only produces dextrogyric lactic acid, at least under the usual conditions of growth.

The author examined a number of starters that had been used in a creamery and found that they did not produce pure dextrogyric acid, but a mixture of active and inactive acids. Starters are thus not pure cultures of *S. lacticus*, and the associated organisms are undoubtedly important in producing a type of non-dextrogyric lactic acid. The results obtained suggest that the associated organisms are able to transform dextrogyric lactic acid into levogyric lactic acid.

F. D.

502 - **Connection between the Number of the Bacteria in the Milk and the Quality of the Cheese obtained.** — HUCKER, G. J. in *New York Agricultural Experiment Station, Geneva, Bulletin No. 486*, 19 pp, 8 figs. Geneva, N. Y., 1923.

This paper is the first of a series of studies on the bacteriology and ripening of cheeses and the connection between this ripening and the bacterial flora of the milk. The data upon which this study is based were collected during the winter of 1920 in a cheese-factory near Philadelphia, where whole milk Cheddar cheeses of the "Young American" type were manufactured. The counts of the bacteria present in the milk were made on samples taken from the milk supplied by 25 members of the cheese factory and on samples taken from the cauldron; in some cases the number of bacteria was estimated from the acidity.

It was found that there is no connection between the bacterial content of the milk and number of marks accredited to ripe cheese, although milk with the maximum of microorganisms (12 to 14 million per cc.), tends to make better cheeses of a constant type, whereas milk with few bacteria produces cheeses of variable quality.

The number of bacteria present in the milk does not appear to have any effect upon the amount of cheese produced.

The character of the species of bacteria in the milk intended for cheese-making is of much greater importance than their number; hence milk intended for the cheese factory should not be judged from the bacteriological standpoint in the same manner as milk to be drunk in its natural condition.

F. D.

503 - **Chemico-Bacteriological Study of Different Qualities of Silaged Forages** (1). — HUNTER, C. A. (Pennsylvania Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XX, No. 7, pp 767-780, diagrams 6, bibliography of 20 works Washington, 1921.

The object of these researches was the study of the nature of the fermentations arising in a mixture of several silaged forages and thus to make

AGRICULTURAL  
PRODUCTS  
PRESERVING,  
PACKING,  
TRANSPORT,  
TRADE

(1) For other studies on silaged forages see: R. Jan. 1916, No. 100; R. Feb. 1916, No. 232; R. Feb. 1918, No. 221; R. Jan. 1919, No. 105; R. Feb. 1919, 257; R. July-Sept. 1919, No. 1010; R. July-Aug. 1920, No. 802; R. May 1921, No. 471; R. Sept. 1921, No. 932. (Ed.)

a new contribution to the study of the still much discussed question of the agents which cause the transformations to which such forages are liable. It was originally believed that these changes were due to the enzymes present in the plants, later they were attributed to bacteria, but at the present time some investigators are inclined to think that enzyme and bacterial action both come into play, although they consider the former to be the more important agent. The hydrolysis of plant proteins, which during fermentation accompanies the increase in volatile and non-volatile acids and the formation of ammoniacal nitrogen, seems to be induced first by enzymes and afterwards by microorganisms.

The forage silaged consisted of: 1) vetch + oats; 2) maize; 3) maize + soya. The two latter were compared and the product was analysed from the bacteriological and chemical standpoints at different stages of ensilage.

These analyses showed very little difference in the fermentation processes in the silaged forage, whether vetch and oats, maize alone, or maize and soya. In the forage consisting of maize only, the bacteria of the *bulgaricus* group were more numerous than in the mixed forages.

The analyses also proved that micro-organisms are the chief fermentation agents in forages to be made into silage; enzymes however play a part in the hydrolysis of the proteins with the formation of aminic nitrogen. The production of acids is due to the micro-organisms, while in the formation of ammonia both enzymes and micro-organisms are equally active. Yeasts appear to have little effect on the fermentation of silaged forage, except during the first few days.

F. D.



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## PLANT DISEASES

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### GENERAL INFORMATION

504 - **Government Enactments in Formosa regulating the Importation and Exportation of Plants.** - INTERNATIONAL INSTITUTE OF AGRICULTURE *Textes législatifs de l'année 1921*, No. 30 (1).

LEGISLATION  
AND  
ADMINISTRA-  
TION FOR  
PLANT  
PROTECTION

1) Edict of April 15, 1921, No. 5 promulgating the law dealing with the importation and exportation of plants. - *Kwampô* (Official Journal), No. 2665. June 20, 1921.

2) Decree of September 10, 1921, No. 142, containing the text of the law controlling the importation and exportation of plants. - *Kwampô*, No. 2753. October 4, 1921.

In the second decree the plants and portions of plants intended both for importation and exportation for which inspection is required are specified. It contains the rules to be observed by any person intending to import or export such plants or portions of plants, as well as the powers conferred upon the officers of the Phytopathological Service; it establishes the conditions under which the importation of injurious diseases and insects etc., may be authorised. Ten forms are appended, *viz.*, request for the inspection of plants or portions of plants to be imported from abroad or from other parts of Japan; request for the inspection of plants or portions of plants to be exported abroad or to other parts of Japan; request for permission to import from abroad or from other parts of Japan, injurious diseases or insects; request for the inspection of injurious diseases or insects to be imported from abroad or from other parts of Japan; request for the inspection of plants or portions of plants imported from abroad (or from other parts of Japan), by means of the ordinary post; label certifying inspection; stamp certifying inspection; certificate of origin for inspection of nursery-garden products; certificate of origin

(1) The text of the decrees of the Formosa Government, and the texts of other enactments to which reference is made later in this article are to be found reproduced in their entirety in the collection of the *Textes législatifs* published in 1921 in separate volumes by the International Institute of Agriculture

The object of this collection is to make known immediately the most important legislative measures referring to agriculture that have been enacted in the different countries of the world. These measures, together with all those not contained in the *Textes législatifs*, will afterwards be included, as usual, in the *International Year Book of Agricultural Legislation*, also published by the International Institute of Agriculture. (Ed.)

for nursery-garden products packed with soil ; label certifying that inspection has been omitted , stamp certifying that inspection has been omitted.

3) Decree of September 10, 1921, No 144 fixing the fifteenth day of September 1921 as the date on which the law controlling the importation and exportation of plants comes into force — *Kwampô*, No 2753, October 4, 1921

4) Decree of September 10, 1921, No 158 defining the powers of the Plant Inspection Station of the General Government of Formosa — *Taiwan noji hô* (Agricultural Review of Formosa) No 179 October 1, 1921

On September 15, 1921 a Government Plant Inspection Station under the supervision of the Director General of Production was established in Formosa. This Station is charged with the inspection and control of the exportation and importation of plants as prescribed by the relevant regulations. It will also undertake studies and scientific research work on injurious diseases and insects. The Governor shall have the power to establish Sub-Stations in suitable places, and to endow them with certain of the powers of the Central Station.

5) Official Order of September 10, 1921, No 136 appointing the post-offices to carry out the provisions of Art 13 of the regulation relating to the control of the importation and exportation of plants — *Taiwan noji-hô*, No 179 October 1, 1921

The order prescribes that ' the post-offices appointed for this purpose shall — when they have received or accepted for dispatch postal packages containing goods subject to inspection in accordance with the provisions of the regulations governing the control of the importation or exportation of plants — notify the Station of Plant Inspection or one of its Sub-Stations. The inspection of the packages shall be carried out in the presence of the postal official '.

6) Official Order of September 10, 1921, No 137, fixing the amount to duty to be paid pursuant to Art 4 of the law dealing with the control of the importation and exportation of plants — *Taiwan noji hô*, No 179 October 1 1921

According to Art 4 a fixed fee shall be paid for the inspection of citrus fruits intended for export to Japan

7) Decree of September 10, 1921, No 143 fixing the places where the inspection prescribed by the law relating to the control of the importation and exportation of plants shall be carried out. — *Kwampô*, No 2753 October 4, 1921

The full text of the law of March 25, 1914, No 11, which deals with the control of the importation and exportation of plants is also added for purposes of reference

G. T

**505 - Decree of April 7, 1921, No. 148, Respecting the Control of *Chrysophlyctis endobiotica* in Czecho-Slovakia.** — *Sbírka zákonů a nařízení*, No 31, April 16, 1921 (Cfr. *Textes Législatifs*, etc., No 12)

The importation into the Czecho-Slovakian Republic of potatoes attacked or suspected of being attacked by "canker" (*Chrysophlyctis endobiotica*), as well as their transport through the country are prohibited. All potatoes imported into Czecho-Slovakia or to be conveyed through the country, are subjected as soon as they reach the frontier, to inspection by the special Phytopathological Commissions which have their Headquarters at specially appointed Experiment Stations. The Decree defines the duties of these Commissions of which the members are appointed by the Ministry of Agriculture.

All consignments of potatoes from abroad must be provided with a copy of the immunity certificate issued by a State Experiment Station, or by a Public Experiment Station of Phytopathology in the country of export.

Every potato grower or land owner is required to notify immediately any case or suspected case of "canker" to the recognised Communal Authority who will in turn at once forward the notification to the Experimental Station of the zone where the case or suspected case has occurred. The potato grower or land owner is further required to forward for gratuitous inspection, a sample of the potatoes to the recognised Experiment Station, in order that all necessary measures may be taken. Pending the conclusion of the examination and further instructions, the potatoes may not be removed.

Districts where the presence of "canker" has been reported or suspected, are declared to be "infected districts" and the potatoes growing therein may not for any reason be lifted except by direct order of the Ministry of Agriculture.

Potatoes infected or under suspicion of infection by "canker" cannot be used for "seed."

The Ministry of Agriculture may proceed after indemnifying the owner, to the confiscation of the diseased potatoes and may prohibit until further notice the raising of potatoes on infected land or land on which infection is strongly suspected, and in this case, compensation may be granted. Should the grower or holder of the potatoes have omitted to declare the presence of "canker", he is not entitled to any indemnity or compensation.

The Experiment Stations that are the Headquarters of the Phytopathological Commissions are responsible for carrying out the measures for controlling the disease.

G T

**506 - Decree of October 25, 1921, Respecting Insectivorous Birds and Bird-Catching, in Belgium.** — *Monsieur belge*, No 315, November 11, 1921 (Cfr. *Textes législatifs*, etc., No. 23)

A list of the insectivorous birds that may not, at any season of the year be caught, killed or destroyed, exposed for sale sold, or bought in Belgium, or conveyed through Belgium to other countries.

[503-506]

The decree contains the regulations governing bird-shooting, bird-catching, the use of and trade in various birds not included in the above category

G T

507 - **Law No. 20 of July 26, 1921, Relating to the Control of the Pink Boll Weevil and of the seed of the Cotton Plant' in Egypt.** - *Journal Officiel*, No 70, August 1, 1921 (Cfr *Lexles leiskutsi* etc, No, 9)

Every year after the harvest, and at latest previous to the dates that will be fixed annually for each district, or zone by the Ministry of Agriculture, the roots of the cotton plant, of "til" (*Hibiscus cannabinus*) and of "bamia" (*H. esculentus*), shall be removed from the ground or cut down below the level of the soil so that they are unable to send out fresh shoots. Within the same space of time all bolls containing seed found lying on the ground ought to be collected and destroyed.

The Ministry of Agriculture has also the power of ordering that all the capsules remaining on the cotton-plants and *Hibiscus* shall be gathered and at once destroyed, even before the dates that are to be fixed annually.

The cotton of each crop must be ginned before the 1st of May subsequent to the harvest.

All the seed of each crop immediately after ginning must be subjected to special disinfection in accordance with the regulations of the Ministry of Agriculture. Without the permission of the Ministry no cotton, cotton seed cotton waste residues etc with the exception of ginned cotton and such seed as has been thoroughly disinfected by the above-mentioned process, shall be removed from the premises where the ginning operations are carried out.

G T

508 - **Plant Quarantine Service in the Philippines.** - See No 510 of this Review

## DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

509 - **Sulphate of Iron and Perchloride of Iron in the Treatment of Chlorosis of the Vine (1).** - I RICHIELLI in *La Propa andu Agricola* Series II Year XIII No 15 pp 206-209 Bari 1921

In treating "chlorosis" of the vine with sulphate of iron it is necessary according to the author, to insure that this salt exerts a rather prolonged action on the root system of the host plant. For this reason instead of applying a solution of iron sulphate to the soil around the diseased vine, it is better to use it in the form of powder which should be well mixed with soil and spread round the vine-stock at a distance of 50-60 cm. The soil is then lightly watered for some days which causes the salt to dissolve gradually and provides the roots with a constant supply of

(1) See R March 1920 No 366 (Fd)

a weak solution, which will not become too concentrated. For this treatment 250 to 300 gm. of sulphate of iron are sufficient.

Better experimental results, as regards efficacy, rapidity and economy, were obtained by the author in the treatment of chlorosis with perchloride of iron than with sulphate of iron if very dilute solutions were employed.

The author advises that perchloride of iron be prepared and applied in the following manner.

A 2 % solution is made by adding 10 to 12 gm. of perchloride of iron to 5 or 6 litres of water. This mixture is poured into a circular trench dug round the vine-stock at a distance of from 50 to 60 cm., in order to get as near as possible to the roots and the trench is afterwards filled in with soil.

By the adoption of this method severely infected vines have been permanently cured, whereas others which were treated with sulphate of iron and appeared to have recovered became chlorotic again after some time had elapsed.

G. T.

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

510 - Reduced Yield of chief Crops, due to Fungoid Diseases, Insects and Animal Pests, in the United States of America. — See No. 370, of this Review

GENERAL

511 - Insufficient Phosphatic Fertiliser a Factor favourable to the Development of Rice Diseases. — See No. 411 of this Review

512 - Varieties of Potatoes resistant to *Synchytrium Solani* in Great Britain (1). — CUTHBERTSON W., in *The Gardener's Chronicle*, Series 3, Vol. LXXI, No. 1836, p. 104. London, March 4, 1922.

RESISTANT  
PLANTS

During the summer of 1917 many potato fruits were gathered in some large fields in Scotland. In each case the fruits were taken from near the centre of extensive zones so that it was probable that the flowers had been self-fertilised and not contaminated by the pollen of other varieties.

The seeds were sown in the spring of the following year, and in October the tubers produced by each of the plants grown from these seeds were lifted.

In the spring of 1919, the six best tubers of each of the varieties used in the experiment were planted at Ormskir. At the harvest at the end of September, careful note was taken of the immunity of the tubers to *Synchytrium Solani*.

From the numerous data thus obtained attention is drawn to the varieties Priory Queen, Favourite and Admiral which all belong to the Abundance type noted for its marked resistance to the parasite.

G. T.

(1) See R. Mar. 1922, No. 226. (Ed)

- 513 - Type of Cotton Plant cultivated in Montserrat, Antilles, resistant to Disease and seldom attacked by "Cotton-Stainers" (*Dysdercus* et *Oxycarenus* spp.). — See No. 368 of this Review.
- 514 - Resistance of Venezuela Cocoa Varieties against Attack of *Monilia*, in the Republic of Ecuador. — See No. 427 of this Review.
- 515 - *Botrytis antherarum-Trifolii*, injurious to the *Trifolium pratense*, in Germany. — See No. 402 of this Review.
- 516 - *Fusarium* sp. a Deuteromycete, the probable Cause of Disease of the Leguminosae, *Crotalaria juncea*, and *C. usaramoensis*, in Tonkin (1). — VINCENS F., in *Bulletin agricole de l'Institut scientifique de Saigon*, Year III, No. 12, pp. 381-384, Saigon, December 1921.

At the end of September 1921, the Phytopathological Laboratory of the Scientific Institute of Saigon (Indo-China), received a large number of diseased specimens of *Crotalaria juncea* from the Agricultural Station at Tuyèn-Quang (Tonkin).

From information furnished by the sender, it appears that the disease begins at the base of the plant and gradually invades the stem, causing it to wither and die. All the crops of *C. juncea* growing at the Station had been destroyed in this manner, and those of *C. usaramoensis* which had long proved resistant to the disease, began to be attacked at the beginning of September. The dry specimens that reached the Institute, did not enable a very clear idea to be formed of the appearance of the diseased plants. The cortex of the stem and roots was affected in the region of the root-collar, and in the case of some specimens where the wood beneath the cortex was discoloured and more or less brown, sections from the affected regions revealed the presence of a hyaline mycelium passing between the cells of the cortex and invading the wood vessels.

Upon stems and roots kept in a damp plate there appeared the characteristic fructifications of the following micromycetes; *Fusarium* sp., *Neocosmospora vasinfecta*, *Melanospora* sp., and subsequently, *Cucurbitaria* sp. and *Diplodia Theobromae* (?). Upon all the plants under observation only *Fusarium* sp. was found; this Deuteromycete appeared after a few days upon the sections of stem and roots containing the hyaline mycelium, and was the only fungus that developed upon the sterile cultural media upon which had been laid fragments of wood taken with every aseptic precaution, after the externally-sterilised cortex had been removed.

From the observations made on the material received *Fusarium* sp. seems to be the probable cause of the disease.

Although the author and his collaborator PHAM-TU-THIEN, have found *Fusarium* sp. and *N. vasinfecta* present at the same time upon *Crotalaria*, it is not certain that these two fructification forms belong to one species.

*N. vasinfecta* is regarded as the perfect form of *F. vasinfectum* a formidable parasite of cultivated plants and, amongst others, of the cotton-plant, in which it produces a serious disease of the root-collar.

(1) See also R. Jan. 1916, No. 123 and R. Jan. 1919, No. 729. (Ed.)

The form of *Neocosmospora* found on *Crotalaria* is morphologically similar to that parasitic on the cotton-plant, this is not the case with the two forms of *Fusarium* and the second conidial form of the *Cephalosporium* type to which they give rise

The Deuteromycete, which is suspected of being the cause of the disease attacking *Crotalaria* in Tonkin, seems to resemble in its morphological characters *Fus udum* which produces the wilt disease of *Cajanus indicus* in India

The symptoms of the disease, and the presence of *Fusarium* unaccompanied by other fungi in the woody tissues of the infected plant, indicate that this is probably an instance of a "pathological withering" identical in origin with the wilt disease described by English and American observers

No direct means of controlling this disease are known. The infection takes place in the soil and it is there that the parasite should be destroyed. Antiseptics have not given results which would warrant their use for farm crops

Good results can be obtained by a rotation of at least three courses. The intermediate crops must not consist of plants belonging to the same family as those which have to be protected by this means. The spores of the parasite remaining in the ground after the removal of the crop will eventually disappear

The best control method is undoubtedly the creation of resistant varieties. By this means particularly encouraging results have been obtained in combating diseases produced by *Fusarium* G. T.

517 ***Colletotrichum Gossypii* and *Cercospora Batatae*, Deuteromycetes new to the Philippines and Injurious to the Cotton Plant and the Sweet potato respectively.** WILLIS C. G. in *The Philippine Agriculturist*, Vol. X, No. 5, pp. 253-254, Los Baños, Laguna, December 1911

*Colletotrichum Gossypii* Southw., the metagenetic stage of *Glomerella Gossypii* (Southw.) Edg., which produces the disease known under the name of cotton anthracnose, has recently been observed on the cotton bolls at the Los Baños College of Agriculture

As this parasite has not hitherto been reported from any other part of the Philippines, the spread of the disease can probably be prevented by careful seed selection and the application of efficient quarantine measures to all cotton grown at the College

The fungus can exist in the seeds and dead tissues in the soil for a long time, and is thus very difficult to control. Cotton should not be grown indefinitely on soils infected by this disease, and as in the case of other crops, recourse must be had to a system of rotation. The danger of infection could be greatly diminished by the removal and burning of the plants after the harvest, while the spread of the disease on the stems of the host plants would be checked by taking the seed from healthy bolls only.

The presence of *Cercospora Batatae* Zimm. has also been observed at

the Los Baños College of Agriculture on the sweet potato ; this is the first time the parasite had been found on that plant in the Philippines, although it had previously been reported as doing great damage to the leaves of the sweet potato in South China. Rotation of crops might prove efficacious ; it would also be advisable to plant the sweet potato during the driest months of the year.

G. T.

518 - *Cercospora Arachidis* var. *macrospora* n. [var., a] Hyphomycete Injurious to the Pea-Nut in Lombardy, Italy. — MAFFEI L., in *Rivista di Patologia vegetale*, Year XII, Nos. 1-2, pp. 7-11. Pavia, March 29, 1922.

On a farm in the Commune of Bereguardo (Prov. of Pavia), during the second half of September 1921, round or oval spots of a dark chestnut colour, and sometimes reaching 1 cm. in diameter, were found, frequently in large numbers, on the leaves of *Arachis hypogaea*.

These spots were caused by a Hyphomycete of the genus *Cercospora*. The fructifications of this fungus developed in the spots on either surface of the leaf.

The parasite, which is new to Italy, is provisionally described as a variety (var. *Macrospora*) of *C. Arachidis* P. Henn :

It is advisable to cut off the aerial portions of the plant attacked and not to feed them to cattle or use them as manure.

G. T.

519 - The Mucoracea, *Rhizopus nigricans*, Injurious to Pumpkins, in Italy. — CIPERRI R., in *Rivista di Agricoltura*, Year XXVII, No. 13, pp. 195-196. Parma, March 31, 1922.

In 1921 a disease appeared in damp and particularly in low-lying places in the neighbourhood of Alba, which although not very wide-spread caused considerable damage here and there among the pumpkins. As soon as the pumpkins ripened, large dark, irregularly rounded spots were seen on the surface and these patches spread so extensively that the fruit became soft and was changed to a brown colour. The pulp of the pumpkins attacked was blackish-brown and the exterior of the seeds also turned brown. The mesocarp from which there exuded a hyaline, non-putrid liquid, was seen under the microscope to be greatly disorganised and invaded by a mycelium, at first hyaline, and afterwards of a greyish colour. In the mycelium were embedded black, roundish bodies (sclerotia), which helped by their number to give to the pulp its blackish colour.

Pieces of infected pumpkin when placed in a moist, warm chamber, soon became covered with a thick growth of a Mucoracea identified as *Rhizopus nigricans* Ehr., a ubiquitous, very common saprophytic fungus, known to occur as an occasional parasite.

In the case of pumpkins all the diseased fruits should be destroyed and they should not be planted in very damp places.

G. T.

520 - *Penicillium crustaceum*, the Cause of Rot in Quinces, in Italy. — CIPERRI R. in *Rivista di Patologia vegetale*, Year XII, Nos. 1-2, pp. 12-17. Pavia, March 29, 1922.

It has been noted that in the Marches, Emilia, Piedmont, and several other parts of Italy, quinces kept in damp places are liable to a chestnut-



brown rot which sometimes destroys the entire crop. At first a very small brown spot like a bruise is seen on the fruit which increases in size and becomes depressed and the tissues of the hollow part soften. At the end of a few days half the fruit is attacked by this rot and gives out the characteristic smell of organic substances in course of fermentation and decomposition. Then a felt, at first of a whitish and later of a bluish colour, makes its appearance on the depressed spot and when the rot has spread to the whole quince it becomes invested with a greenish-blue covering of different shades.

The microscopie has shown this affection to be the work of the polymorphous fungus *Penicillium crustaceum* (L.) Fr. a very common saprophyte and a facultative parasite.

The epicarp of perfectly healthy quinces when scratched by a needle infected with the conidia of this *Mucedinea* exhibits all the characteristic symptoms of the disease. If the conidia are placed on an entirely unbroken epicarp the results obtained are negative.

In order to prevent the outbreak of this disease all quinces intended for storage must be free from any lesions and the fruit should be kept in a very dry place. The quinces must not touch one another and should not be piled up in heaps.

G. T.

#### WEEDS AND PARASITIC FLOWERING PLANTS

5.1 - *Striga densiflora* and *S. euphrasioides* Scrophulariaceae Parasitic on the Sugar Cane in India. IUTRA JAI CHAND in *The Agricultural Journal India* Vol. XVI Part 5 pp. 515-53 pl. 3 Calcutta 1921.

In September 1920 the sugar canes (var. Katha) grown on the banks of the Sutlej were reported to be seriously affected. On investigation it was found that the plants were severely attacked by parasites belonging to the genus *Striga* (fam. Scrophulariaceae). Two species were discovered which were subsequently identified as *S. densiflora* Benth. and *S. euphrasioides* Benth. These plants grew in great numbers from the base of the sugar-canes, hundreds being missed together on a single spot. Groups of them were also found at a certain distance from the sugar-canes, but they were connected underground with the individuals attacking the root system of their hosts. The two species of *Striga* were met with in different plantations. *S. densiflora* grew in the villages of Shergarh, Fatehgarh, Makowal etc. and *S. euphrasioides* in the fields of sugar cane and of *Indropogon Sorghum* belonging to the village of Pawat.

The presence of *Striga* plants was remarked about seven years ago in the village of Garhi in the territory of the State of Patiala and they have also been seen for three years at Shergarh and at Fatehgarh.

The sugar-canes attacked by the parasites are weakly, the leaves wither and the whole plant appears to be suffering from drought. Some of the sugar-canes are killed by the pests, whereas others are but little injured.

*Striga* has a very well developed root-system which encloses the rootlets of the sugar cane like a net. A number of suckers are put forth by the roots of the scrophulariaceae which fasten upon the rootlets of the host, and in this manner the parasite obtains all the nourishment it requires.

It is propagated only by seeds which when ripe fall in great quantities to the ground and grow at the same time as the host plant.

So far it has not been possible to make any specific recommendations as to control measures, but as in the case of other parasitic phanerogams, e. g. *Orobanche*, the development of *Striga* could doubtless be checked by pulling up the plants before the shoots have time to flower.

Since the cotton plant is not subject to the attacks of *Striga*, it is advisable whenever possible to grow cotton instead of sugar-cane in zones infested by these parasites.

G. T.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

522 - On the Etiology of the Potato Disease known as Tip-burn in the United States (1). — EYER J. R., in *Science*, New Series, Vol. IV, No. 1416, pp. 150-151, Utica, N. Y., February 17, 1922.

Researches have been made of recent years at the Experimental Station of Pennsylvania State College with the object of determining the etiology and specific cause of the potato disease called tip-burn due to the attack of *Empoasca mali*.

The experiments were carried out in the form of a series of inoculations with aqueous and alcoholic extracts of the Rhynchote and other insects living at the expense of the potato. The inoculated plants were placed in special cages and exposed to sunlight of different degrees of intensity in order to determine how far sunlight influences the development of the disease.

The results obtained led to the following conclusions :

1) Tip-burn of the potato can be induced by means of an extract obtained by maceration of the nymphs or adult forms of *E. mali* and is transmissible by direct inoculation ; this indicates the presence of some specific substance, either inherent or of external origin and transmitted by the Rhynchote which is the actual cause of the disease.

2) The active principle of this substance is more energetic in the nymph stage of the Rhynchote.

3) The specific substance is present in the tissues of the diseased leaf after inoculation with the Rhynchote extract and can be transmitted by reinoculation to healthy plants.

4) This substance is of a definite nature and the disease cannot be induced by inoculation with extracts of insects other than *E. mali*, or by mechanical injury.

(1) See also R. Feb. 1922, No. 215. (Ed.)

5) Sunlight plays an important part in the progress of tip-burn after it has once begun, but the absence of sunlight does not prevent its appearance.  
G. T.

523 - Observations made on the Life-History of *Laspeyresia pomonella* in the Valley of the Grand Colorado. — SIEGLER E. H., and PLANCK H. K. (in collaboration with the Colorado Agricultural Experiment Station,) in *United States Department of Agriculture, Bulletin* 933, 119 pp., figs. 36, pl. 7. Washington, D. C., 1921.

*Laspeyresia pomonella* L., which is generally regarded as the most destructive enemy of apples and pears, is very common and very destructive in the Valley of the Grand (Colorado).

In view of the great losses caused by this Microlepidopteron to the fruit industry of the district, it was considered advisable that a complete study of the life history of the insect should be made, in order to obtain some basis for control experiments.

These biological investigations were begun in 1915 and continued the following year according to the scheme devised by the Bureau of Entomology of the United States in collaboration with the Colorado Agricultural Experiment Station.

The Valley of the Grand is situated in the county of Mesa on the Western slopes of the Rocky Mountains, and possesses a relatively dry climate. The day temperatures are high during the summer, but the night temperatures are comparatively low.

These conditions are so favourable to the development of *L. pomonella*, that there are two complete generations and one incomplete generation of this insect during the year.

The authors give a detailed account of the careful observations made in each of the above-mentioned years on the subjects of the duration of the chrysalis stage of pupation of caterpillars that have over-wintered; the deposition of eggs by the females coming from these caterpillars, the number of eggs laid by each female and the length of the life of the adults (both males and females) derived from the caterpillars that have over-wintered. The authors also give the most minute details of the biological investigations respecting the different stages of the first, second and third generations of the insect.

In the Valley of the Grand, the natural enemies of *L. pomonella* are of little importance.

The beetle *Tenebroides corticalis* Melsh. and the Arachnid *Coriarachne versicolor* Keys. have been reported as preying upon the caterpillars of the Microlepidopteron. An unsuccessful attempt was made to introduce a very well-known Coleopteron *Calosoma sycophanta* L. *Trichogramma minutum* Riley and *Dibrachys clisiocampi* Fitch have been found parasitic on the eggs and caterpillars respectively. The parasite *Arthrolytus apatela*. Ashmead has been obtained by breeding.

The adult individuals of *L. pomonella* hatch later in orchards than in fields, but the period of hatching is shorter in the orchards. Most of the adult insects, whether derived from the caterpillars that have hibernat-

ed or from those of the first generation, emerge during the latter part of the morning and the early hours of the afternoon, the largest number appearing as a rule between 9 and 11 a. m.

*L. pomonella* makes short local flights, but does not otherwise appear to be a migratory insect. The adults can however make continuous flights, of at least eight hundred metres, without any assistance from the wind.

The females of the microlepidopteron lay most of their eggs between late afternoon and early evening, ovipositing being especially active at dusk.

*L. pomonella* is very productive in the valley of the Grand. Three females of the first generation laid in captivity over three hundred eggs each, the largest total number of eggs laid by a single female being three hundred and sixteen, while the largest number laid in a day by one female was a hundred and fifteen.

On June 24, 1915 an orchard consisting entirely of pear-trees was examined in order to determine the cause of the leaves turning brown. It was found that the change of colour was due to the caterpillars of *L. pomonella* which, having found no fruit at their disposal, had excavated galleries in the ends of the branches of the pear-trees.

In districts where there are large numbers of *L. pomonella*, bands are very often used instead of sprays in the control of the insect. A band of material is placed round the trunk of the tree and removed about every ten days when any caterpillars that have made their cocoons under the band are destroyed.

In 1916 an experiment was made by surrounding trunks with bands of material folded in such a manner that white stripes alternated with black, and this proved that the microlepidopteron preferred to pupate under the dark portions. In must not be assumed however that the light bands are useless, for it is probable that if the caterpillar can find no better place to spin its cocoon, it will content itself with making it beneath them. In practice fruit growers have found that bands of packing cloth folded two or three times answer the purpose quite well.

The variety of the Microlepidopteron to which was given the name of *L. pomonella* L. var *simpsonii* Buck. was reared during the course of the study of the apple parasite from material collected in the open in the Valley of the Grand.

G. T.

524 — Propagation of Date Palms by Cuttings favouring the Development of *Phoenicoccus Marlati*. See No 435 of this Review. (Ed.).

525 — Resistance of *Coix Lacryma Jobi* var. *mayuen* to animal Pests in the Philippines. — See No 412 of this Review

526 — *Triphleps tantilus*, a Natural Rhynchote Enemy of the Pink Cotton Boll Weevil (*Platyedra gossypiella*), in India. — BALLARD F., in *The Agricultural Journal of India*, Vol. XVI, Part 5, pp. 571-573. Calcutta, 1921.

In 1921 *Triphleps tantilus* Motsch. appeared in large numbers at Coimbatore, which confirmed the statement made in the preceding year that

this Rhynchote can live as well upon the eggs as upon the scarcely hatched larvae of the Pink Cotton Boll-Weevil. The nymphs of *Tr. tantilus* seem to attack the boll-weevil more greedily than the adult insects. A laboratory experiment has shown that the nymphs of the Rhynchote prefer the caterpillars to the eggs of *Platyedra*. It is unlikely that *Tr. tantilus* often has an opportunity of catching the *Platyedra* caterpillars in the open because as soon as they emerge from the eggs the caterpillars find their way into the nearest bolls. As, however, *Pl. gossypiella* lays its eggs in places that are much frequented by the Rhynchote, a large number must be destroyed by *Tr. tantilus*, which also lives upon other insects that are parasites of the cotton-plant. G. T.

- 527 - ***Terpsiphone paradisi*, A Bird Useful to Agriculture in India.** — FLETCHER T. B. and INGLIS, C. M., in *The Agricultural Journal of India*, Vol. XVI, Part 5, pp. 479-482, 1 coloured Plate, Calcutta, 1921

The authors give the descriptive characters of *Terpsiphone paradisi* (Paradise Flycatcher), and describe its habits.

This bird is found throughout India, from Afghanistan and Cashmere to Ceylon, except in the North-West to the East of the Brahmapootra, where it is replaced by *T. affinis*. It is to be met throughout the year in most of the districts of the plain, but it makes local migrations for definite periods. *T. paradisi* seems particularly common in North India. It feeds on small beetles, Diptera, Rhynchotes, Formicids and Arachnids, which it catches on the wing. It thus does great service to agriculture and for this reason is protected by law in Bengal, the Presidency of Bombay and in Burmah. It is probably protected also in Mysore. G. T.

- 528 - **Insect Enemies of Rice in the Philippines.** — See No. 400 of this Review.

- 529 - ***Leptocorisa acuta*, a Rhynchote injurious to Rice in the Philippines (1).** — UICHANCO, I., in *The Philippine Agricultural Review*, Vol. XIV, No. 1, pp. 87-125, 4 pl. Manila, 1921

It would appear from the entomological investigations that have been carried out for fifteen years by the Bureau of Science in all parts of the Philippines, and from experiments made for four years in the open by the author at Los Baños and in the neighbourhood, that the representative of the genus *Leptocorisa* which attacks rice crops in these islands may be identified as *L. acuta* Thunb, known as the "rice bug." STAL has also reported the presence of *L. varicornis* Fabr (2) in the Philippines in 1870, but judging from the descriptions given by DISTANT, the characters ascribed to *L. acuta* and *L. varicornis* do not vary sufficiently for the two insects to be regarded as belonging to distinct species.

This Rhynchote is known in many parts of the Philippines under very similar local names.

(1) See also R. Jan. 1913, Nos. 27 and 120; R. Oct. 1914, No. 971. (Ed.)

(2) See R. Oct. 1914, No. 971, and R. May 1918, No. 604. (Ed.)

*L. acuta* is widespread throughout the Philippine archipelago and causes much damage in all the rice-growing provinces. It is also known in India, China and Java — where it is commonly called “walang sangit” (1), — in Celebes, Sumatra, Borneo and others of the Sunda Isles, as well as in Australia. Very probably it exists also in Japan.

Up to the present no study has been made of the life-history of the insect in the Philippines.

During the coolest hours of the day, in the early morning and late afternoon, the nymphs and adults of *L. acuta* may be seen on the young rice panicles. Towards midday the insect seeks refuge from the intense heat of the sun and retires to the lower parts of the plants such as the leaf bases.

Although a certain number of the Rhynchotes may sometimes be found on a single rice panicle, *L. acuta* has never been observed to be gregarious during any of its developmental stages. In the rice fields the adults are usually more plentiful than the nymphs.

On the farm of the Agricultural College at Los Baños it was observed that a considerable number of *L. acuta* in all stages of development made their appearance in August, September and October, becoming numerous in November and still more plentiful in December. In the two latter months the caryopses of the rainy season rice crops are in the soft stage. In January when there is generally a drought accompanied by a very high temperature, the Rhynchote can obtain but little suitable food and its numbers therefore decrease in this and the two or three following months. Rice grown during the dry period and reaching the soft stage about March or April and during the first half of May, when it is generally very hot and dry, has been found to be less attacked by *L. acuta* than rice cultivated during the rainy season.

From the time it leaves the egg and throughout all subsequent stages the Rhyncote is capable of injuring the rice grain. The insect feeds on grains which are still in the soft stage, by inserting its sucking apparatus at the point of least resistance, namely at the conjunction of the paleae. Some days after the puncture has been made, a yellowish-brown spot is seen on the paleae, which increases gradually in size and marks the place of the wound. The grain that has been attacked does not develop normally and, though it may attain the ordinary size, is never more than an empty envelope. It is uncertain whether the subsequent growth of the caryopsis is hindered by the direct effect of the mechanical lesion produced by the insect sucking out the contents of the grain which is in course of development, or by the introduction into the grain of an enzyme or some other deleterious substance during its attack. Such seeds as shown by their external appearance that they have been attacked by *L. acuta* have a bitter or unpleasant taste which would seem to indicate that these pathological results must be due to other factors than a simple mechanical injury.

(1) See *R.* Oct. 1917, No. 978 and *R.* Feb. 1919, No. 260, (*Ed.*)

The nature of the injury wrought by *L. acuta* causes it frequently to be mistaken for the work of *Schoenobius incertellus* Walk (paddy-borer), but in this case, all the grains of the panicle are empty and of a uniform pale straw colour, whereas when a panicle has been attacked by *L. acuta*, owing to the insects' method of feeding, some only of the grains are empty, while the rest develop normally, further, the characteristic yellowish-brown spots are to be seen on the panicle at the spot where the insect has inserted its sucking apparatus.

*L. acuta* probably causes more economic damage to the rice crop in the Philippines than any other insect and the crops of rice grown during the rainy season are often diminished 50 % or more owing to its attacks.

If one rice field is planted earlier than the others in the same neighbourhood, the rice which has been first planted attracts all the individuals of *L. acuta* present in the district as soon as it has reached the soft dough stage. One planter of Bay (Laguna) lost over 70 % of his rice crop in 1918 for this very reason. Similar results occur when early varieties of rice are planted with late varieties.

From observations made at Los Baños in 1918 *L. acuta* appears to have a decided preference for certain varieties of rice. Binicol for instance is particularly liable to attack, possibly on account of its sweeter taste and characteristic smell, coupled with the fact that the paleae are not so strongly united, which facilitates the passage of the proboscis of the insect to the carvopsis.

Most of the awned varieties have proved to be immune, the awns probably acting as a protection against the intruder. Further, in these varieties, the paleae are stronger and more solidly united at the angles.

*L. acuta* is only able to injure rice grain when it is in the soft dough stage.

During the months when rice is not grown, or when it has not reached the soft stage, *L. acuta* lives at the expense of various wild plants. The insect seems, however, to prefer rice to any other of its host plants and returns to it at the earliest opportunity.

Adult individuals of the Rhynchote have been seen in the Philippines, far from any rice plants, on *Panicum flavidum* and *P. colonum* and when these Gramineae were growing together on the same ground, the insect always showed a preference for the second, no doubt because its grain is the more succulent. The nymphs of the Rhynchote have been found on *Digitaria consanguinea*. The insect has also been reported as living at the expense of *Citrus* sp. Its eggs have been found on a leaf of *C. decumana* and egg-capsules on a leaf of *Phytolacca dioica*, but experiments have shown that *L. acuta* cannot obtain a suitable food supply from either *C. decumana* or *Phyt. dioica* and that the eggs found on the leaves of these plants had probably been laid there by accident.

Subsequent experiments carried out with nineteen species of plants many of which represented the commonest weeds of the rice-fields, at Los Baños and its neighbourhood, have shown that *P. colonum*, *P. flavidum*, *P. Crus-galli*, *P. reptans* and *D. consanguinea* act as good host-plants to

*L. acuta*, for some individuals have been able to reach the adult stage, mate, and deposit eggs upon them. From the results of the experiments it appears that *Andropogon Sorghum* which is stated to be a host of *L. varicornis* in India, does not furnish food suitable to *L. acuta*. In the laboratory the *L. acuta* does fairly well on *Paspalum conjugatum*, *Panicum barbinode*, *Dactyloctenium aegyptiacum*, *P. carinatum*, *Cynodon Dactylon*, *Eleusine indica* and *Cyperus Iria*, but only until it has reached the second or third phase of the nymph stage. The author cannot at present say for certain that these latter plants are less suitable hosts from the food point of view than the 5 others mentioned above. The premature death of the nymphs might have been due to other factors and not to unsuitable nourishment.

Although the results of these experiments do not justify any definite line to be drawn between the plants upon which the Rhynchote can feed and those that are unsuited to it, they show that some wild plants are good hosts for the insect.

The author gives a detailed description of all the stages of the Rhynchote.

Under laboratory conditions it was found that the male lived from twenty-six to ninety-seven days after hatching, the average being sixty-two days; the females lived from sixty-five to a hundred and twenty-four days, the average being eighty-nine days.

The female does not attain sexual maturity until after a period varying from seven to twenty-seven days after hatching.

Mating takes place at least three times during the life of the female, and always in the morning.

Oviposition is most active from six in the evening to six in the morning.

The female lays her eggs from eleven to forty days after hatching out, the average being twenty-four days. Under laboratory conditions it has been found that the length of the laying season varies from thirty-eight to eighty-two days, with an average of sixty-five days and the female lives eleven days after the end of the laying period. The number of eggs deposited by one female in a day varies from none to twenty-three and the total number of eggs laid during the season varies from a hundred and five, to three hundred and thirty-four with an average of two hundred and twelve.

The eggs are generally deposited in one or two linear series along the median vein, on the upper surface of the leaf, at a short distance from the tip.

In the laboratory the incubation period varies from six to eight days, with an average of seven and a quarter days.

The nymph moults five times before attaining the adult stage; the complete nymph stage extends over a period of time varying from seventeen to twenty-three days, with an average of 19.6 days.

In addition to the absence of wings and of reproductive organs in the nymph and the difference in the number of segments the chief characters distinguishing nymphs from adult insects are the position of the scent



organs, which in the nymphs are situated between the third and fourth and the fourth and fifth abdominal tergite, whereas in the adults they are placed on the metathorax; and in the number of the tarsal segments, two in the case of the nymph and three in the adult insect.

The predatory Coleopteron *Cicindela sexpunctata* Fabr., which the author has never been able to find in the course of his researches, and a Hymenopterous egg parasite belonging to the family *Proctotrypidae*, have been reported as natural enemies of *L. acuta* in the Philippines.

As a result of his biological observations, the author makes some suggestions respecting the control of *L. acuta* as a starting point for further investigation.

In the first place everything should be done to increase the number of the egg parasites named, and it is necessary to import from India and other old rice-growing countries, egg-parasites as well as predatory insects that are not found in the Philippines.

The rice ought to be planted in such a way as to insure that all the crops grown during the rainy season reach the soft dough stage at about the same date in a given locality. Wherever water for irrigation is plentiful it is advisable to delay planting, so that the grain may not reach the soft dough stage before the end of January, or even as late as February.

Care should also be taken to obtain, by means of selection and crossing, types of rice that are either immune or nearly so.

Since early crops of rice planted on a small area are a great attraction to the Rhynchote, many such small plantations should be made in several places in a given district to serve as traps. After the adult insects have collected in large numbers in these small rice-fields and have laid their eggs, the plants can be burnt and in this way the adult individuals, the eggs, and any nymphs that may have developed, are destroyed. The adult insects can be attracted by pieces of putrifying meat or other suitable bait, and then killed.

They can also be captured in special long bags which are dragged across the field, as is done in India.

During the rice-growing season weeds which ripen before the crop and form hosts for the Rhynchote must be uprooted from the rice-fields. The slopes should also be cleared of all weeds. After the rice has been harvested the ground ought to be ploughed and planted with another crop, and should not be allowed to be invaded by weeds, as commonly occurs in many parts of the Philippines.

The eggs may also be collected by hand.

Insecticides acting by contact, such as kerosene emulsion, and applied by means of a knapsack sprayer may be very efficacious, especially in controlling the nymphs, which generally congregate on the panicles during the coolest hours of the day. The spraying should be carried out early in the morning, or late in the afternoon and the insecticide must only be directed against the panicles. As rice is only subject to the attack of the Rhynchote during the soft stage which lasts for about a month, the treatment must be limited to this period. The spraying should be repeated

fairly frequently during the month in order to destroy any insects that may have fallen on the ground, or otherwise escaped the previous applications.

G. T.

530 - *Dysdercus* sp., a Rhynchote injurious to *Hibiscus Sabdariffa* var. *altissima* in the Federated Malay States. — See No 420 of this Review

531 - *Laphygma exempta*, a Macrolepidopteron Injurious to Sugar Cane and Maize, new to Queensland. — JARVIS, L., in *The Queensland Agricultural Journal*, Vol XVI, Part 4, pp 276-280, 1 plate Brisbane, 1921

The presence of *Laphygma exempta* Walk. was reported for the first time at Meringa near Cairns, on February 18, 1920. The larvae were already more than half-grown and had done considerable injury to the leaves of the sugar-cane and to the young maize plants.

The caterpillars were swarming in thousands over an area of about one hundred acres, but were still more numerous on the grassy strips and the edges of the fields

They carried on their depredations in the full sunlight and could be clearly seen eating up the greater part of the leaf blades of which they often left only the median vein intact.

By February 21 the larvae were fully grown. Two hundred of them were collected and put into breeding cages and after two days all the caterpillars burrowed in the soil to pupate.

The chrysalis stage lasted from seven to eleven days, the first adult insect emerged on March 1. During the following 5 days forty-one adults appeared, of which twenty-five were males and six females. Only 20 50 % of the two hundred caterpillars reached the adult stage. They were parasitised in the proportion of 33 50 % by a Tachnid, 1 % being attacked by Hymenoptera. The forty-five other caterpillars apparently succumbed to the attack of a disease of bacterial origin.

The author gives a description of the caterpillar, chrysalis, and adult, form of *L. exempta*. This Macrolepidopteron is a native of Africa, and appears never to have been observed before in the Queensland sugar-plantations.

In addition to the parasitic Tachnid already mentioned, its natural enemies are the parasitic Hymenoptera *Melopus unifestratus* Mer., and *Iphnaulax dubitorius* Fabr., and the predatory Coleopteron, *Ophonoides australis* Dej.

Should the insect do further damage, it is well to remember that the young caterpillars must be destroyed as soon as they appear. The method with a poisonous solution usually adopted is to water the grass between the bands of caterpillars and the crop to be protected.

The following formula is prescribed in Rhodesia: sodium arsenite 1 kg., liquorice, 8 kg.; water, 1 hectolitre.

When the attack is confined to a limited area, it is better to use a solution of calcium arsenite to which has been added 600 gm. of liquorice per hectolitre of water

G. T.

532 - *Cerococcus parahybensis*, a Scale-Insect found on the Coffee Plant, in the State of Parahyba, Brazil. — MOREIRA, C., in *Chacaras e Quintais*, Year XIII, in Vol. XXV, No. 1, pp. 28-30, figs. 2. São Paulo, January 15, 1922.

*Cerococcus parahybensis* Hempel, popularly known under the name of "vermelho", is most probably a parasite of the coffee-plant in the State of Parahyba, where, however, its presence was noticed only in 1921.

This scale-insect does not spread rapidly in the zone of coffee-cultivation, and is only represented there by a limited number of individuals on each plant. When this pest occurs in large numbers upon coffee-plants that have already been weakened, it furthers the destruction of the plantations, though in many cases this cannot be attributed to the insect, but is due to negligent cultivation.

The number of female insects exceeds that of the males.

The development of *Cerococcus parahybensis* is favoured by damp, and the parasites multiply greatly in the rainy season. The breeding season lasts from July to August and in October when the dry season is at its height, the insects have been found in a dying condition.

Some traces of natural enemies of this coccid have been observed.

It is impossible to employ insecticides, but the insects can be removed by the application of a hard brush or by hand.

It is necessary to cut down and burn any neglected coffee-plants that have been attacked by the parasite. The spring cultivation of the coffee plantations in the State of Parahyba should be improved, and apart from the seeds, all transport or removal of young coffee plants, or parts of plants, within the State should be prohibited. G T.

533 - *Ypsolophus marginellus*, a Microlepidopteron injurious to the Juniper, New Jersey, United States. — WEISS, H B, and LOTT, R B, in *Entomological News*, Vol XXXIII, No 3, pp 80-82. Philadelphia, March 1922

This European species has been reported in America from the State of New York, Connecticut and New Jersey, where it occurs in its larval stage upon the Juniper.

For several years *Ypsolophus marginellus* Fabr. (the Juniper web-worm) has been increasing in various parts of New Jersey, where it has done considerable damage. At the present time this Microlepidopteron is certainly to be found at Rutherford, Scotch-Plains, Springfield and New Brunswick, where it is especially common in the nursery-gardens. The caterpillar appears to confine its depredations to the leaves of *Juniperus communis* and of its varieties *aurea*, *horizontalis*, *depressa*, *hibernica* etc. The insect winters between the leaves which it fastens together by means of a web, retiring into these nests when from half to fully grown.

In the north of New Jersey, the larvae begin active life in May; they live on the more or less dry leaves, until they attain their full development when they pupate in large numbers after the middle of the month. The insect encloses itself in a white silky envelope placed between the partially eaten leaves which are covered with a web. The first adults come out towards the end of May or at the beginning of June; the largest number emerging about the middle of June. The eggs are laid singly, and quanti-

ties are usually found on the young terminal shoots, in the angle between the stem and the leaf insertion ; eggs are also sometimes laid on the shoots or stems. The incubation period has not been definitely observed : the first caterpillars, 0.5 mm. in length, were seen on July 8. On leaving the egg the larvae begin feeding on the upper epidermis of the young leaves, which become discoloured in places and finally turn entirely brown. Towards the end of July, when the caterpillars are about 2 mm. long, their webs are clearly visible. As the larvae grow, their gregarious tendency becomes more evident, and the leaves of the host-plant are more thickly enveloped in the webs. These webs first enclose the terminal shoot and then envelop the branch for some centimetres below the tip this is repeated at different points on the plant which is thus destroyed. As the season advances the webs increase in size, they contain more excrement, and the leaves wither and die. Small plants such as those of the *hibernica* variety may be entirely covered by the webs from top to bottom. There appears to be only one generation of *Ypsolophus marginellus* in the year ; the larvae grow slowly during the summer and hibernate throughout the cold season. In the spring when they again become active, the caterpillars find little green food at their disposal and appear to content themselves with dead leaves. Fifteen or more of these grubs, are found nestling in a web.

The authors give a morphological description of each stage of the *Microlepidopteron*.

As regards control, they advise treating the infested plants with lead arsenate, either in the liquid or powder form, during the last fortnight of June or the first half of July, for at that time the webs are small, thin and easily penetrated. Later on powder cannot be employed, and it is necessary to have recourse to spraying, in order to penetrate the foliage which is most closely enveloped by the webs of the insect. In the case of certain varieties of juniper, the nests containing the caterpillars can be cut off and burnt at the beginning of spring.

G. T.

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**INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES**

**INTERNATIONAL REVIEW OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE**

**MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES**

**FIRST PART  
ORIGINAL ARTICLES**

**Improvement in Administrative Methods  
in the Belgium Ministry of Agriculture**

by M. MAT.

*Technical officer in the Ministry of Agriculture, Brussels.*

The public services are as a rule the object of much adverse criticism. Wrongly or rightly the public accuses them of being insatiable ogres who devour a large part of the revenue ; complaints are made of the great number of officials and their inadequate output, of official delays and red tape, — in short, all possible shortcomings are laid to their charge. In Belgium they have not escaped from this chorus of criticism and attack. Are we therefore justified in concluding that the services are in fact not up to their work, or is public opinion in the wrong ? The truth, as is so constantly the case, is not to be found at either of the two extremes, but somewhere midway between them. Undoubtedly these services stand in need of certain reforms. In the absence of a well matured and harmoniously balanced programme, they seem often to be travelling without any definite direction. Their working methods are not the best adapted for modern requirements, they are insufficiently elastic and progress is too slow. The methods employed in the recruitment of officials do not always exact the required guarantees and the better elements do not receive the encouragement they deserve.

Several prominent men have recently undertaken the laborious and thankless task of analysing in detail the deficiencies of administrative systems, of investigating the causes and indicating the remedies. While in France M. FAYOL was publishing his remarkable treatise on administrative theory, M. DE VUYST in Belgium, during the German occupation, was devoting himself to similar work. Immediately following on the Ar-

mistice, M. DE VUYST was put in charge of the Second Branch of the General Administration of the Ministry of Agriculture, and so obtained an opportunity for putting a new administrative method to the test.

Before examining this method in detail it is interesting to note the mission and function of this particular Department. It has the charge of all forms of agricultural instruction and propaganda. For carrying out its duties, provincial staffs have been set up, including agricultural experts and agricultural household economy instructors and horticultural advisers, whose duties consist on the one hand of giving instruction to farmers and their wives on technical and practical questions, and on the other of keeping the Central Administration well informed as regards the general agricultural position and the forms of encouragement that should be granted.

The Administrative Department therefore forms a kind of centre receiving and coordinating reports from its outside officers, while in turn it issues commendations and advice which are the results of the examination of the questions submitted to it. Its work is obviously of extreme importance and any improvement brought about in any one of its activities cannot fail to have far reaching results.

The method introduced by M. DE VUYST into his office is based on a recognition of the 5 chief functions of administration, viz. foresight, organisation, executive work, coordination and control. These 5 factors should function simultaneously in order that the system may give the best results. The following is a description of the way in which these principles have been applied in M. DE VUYST's department.

**FORESIGHT** — Formerly, administrative bodies had no well defined programme; instead of anticipating, they rather waited on events, and their action was rather curative than preventive.

As a result of this absence of programme, the development of the different branches of a single administration was proportioned not to the real place which each should occupy in relation to the whole, but to the intelligence and activity displayed by the individual chiefs. It followed that in the long run, subordinate services tended to absorb funds, staff and accommodation out of all proportion in relation to other services of much greater importance.

There is nothing of this kind to be found in the office of M. DE VUYST, who, immediately after the Armistice, initiated and developed a programme of work extending over a period of three years and including 54 specific points. All the officials without distinction were invited to collaborate in the working out of this programme, which has been so far realised that by the end of December 1921, a new set of developments had already been planned. Included in the work that has actually been accomplished, the following are especially worthy of mention; the establishment at Ghent of an "Institut agronomique flamand"; the establishment of an "Institut supérieur d'agriculture" for young women rural workers at Laeken; the organisation of a service of agricultural household science advisers, whose duties towards the women on the farm are parallel

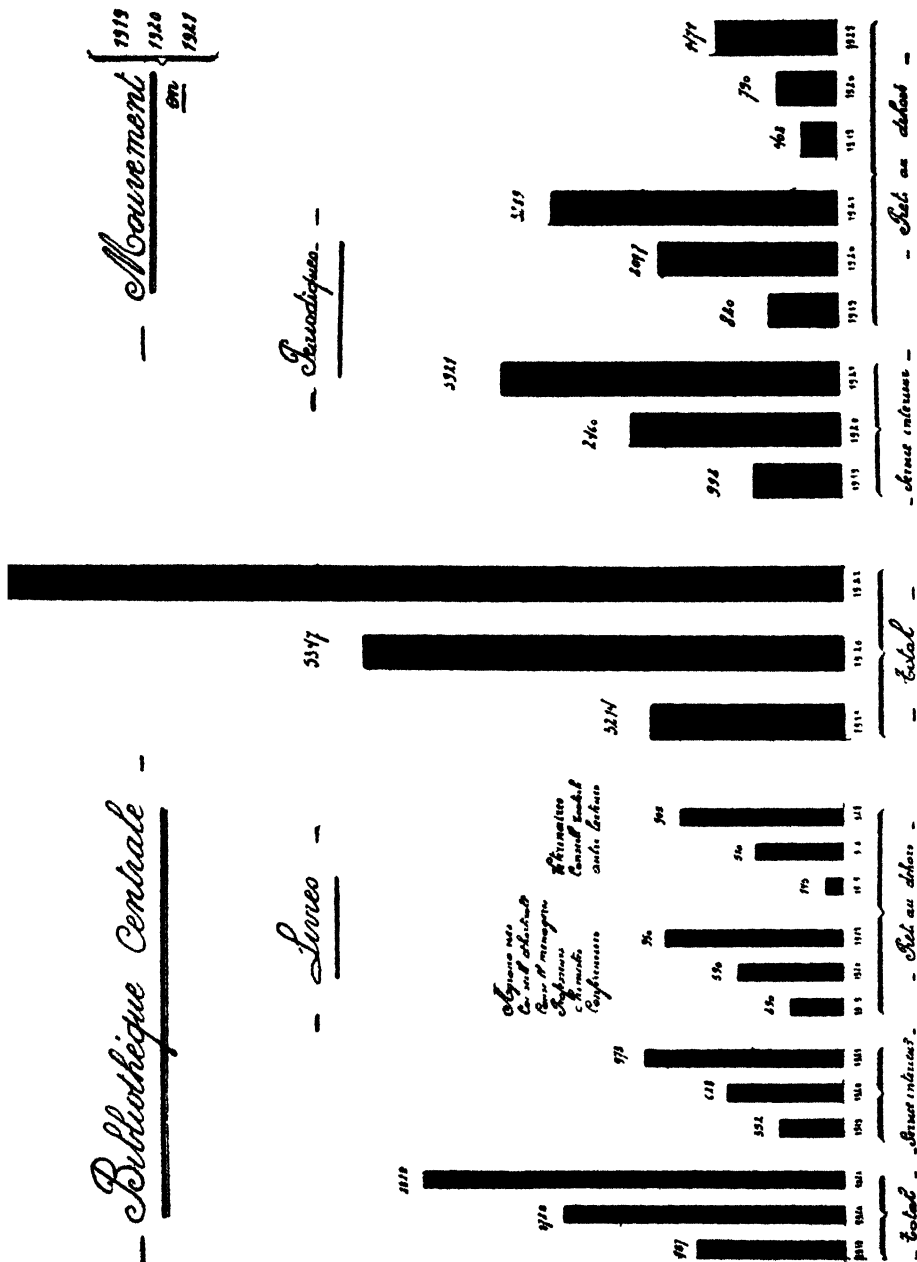


FIG 1 — Numbers of books and periodicals issued by the Control Library.





with those of the male State experts towards the farmers themselves; the revision of the laws with regard to agricultural education; the im-

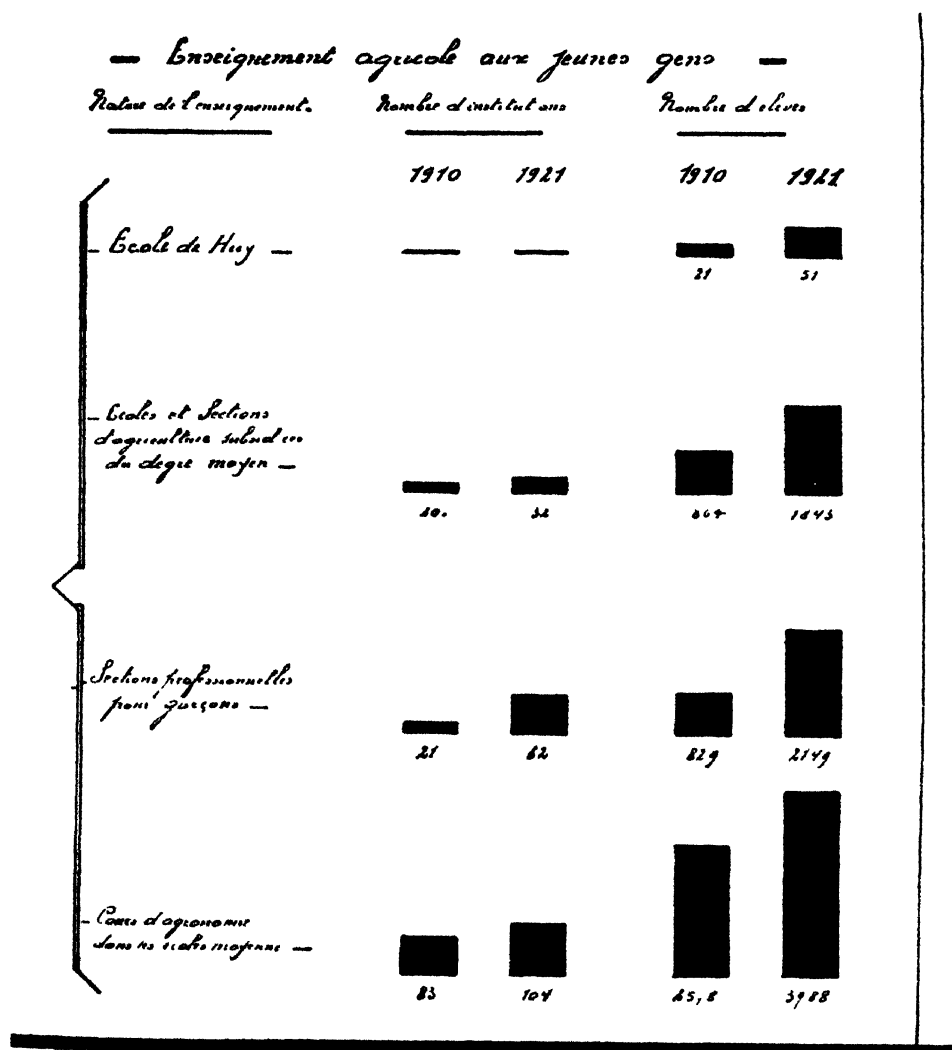


FIG 3 — Position of intermediate and technical agricultural education in 1919 and in 1921

mediate increase in agricultural production, by means of trials of improved seed strains and fertilisers, direct appeal to the farmers, pamphlets on seed selection etc.

The new programme makes special provision for the extension of technical agricultural instruction after the school age; the establishment

of a loan service of agricultural films and slides, and the encouragement of the publication of good agricultural manuals.

This programme is posted up in all the offices, so that the officials have it constantly before their eyes.

**ORGANISATION.** — By the application of the principle of the division of labour, the instructional service has been subdivided into sections and sub-sections, each dealing with some special branch.

The composition of the staff is so regulated that if the chief has to be away, there is always some one to take his place in the office. Visitors are therefore always sure to obtain the information that they require.

The duties of each official are fixed with regard to his special knowledge, aptitude and previous experience.

The chiefs of the services carry out inspection in the country for two days in the week and are in their offices for the remaining four. Hence an inspector is always at the same time an administrator, so that he can be sure that any course of action suggested to him by his visits on the spot will be carried out in accordance with his wishes.

**EXECUTIVE WORK.** — One of the great evils from which administrative offices used to suffer consisted in the too frequent changes in the duties assigned to the officials. With the appointment of a new Chief, important modifications were introduced into existing staffs and duties were redistributed. Sometimes these changes were solely inspired by political or personal considerations. An element of permanence is important in official life by reason of its value in producing officers with special knowledge and experience. Another evil was to be found in the indifference which the chiefs too often showed their subordinates whose output they made no effort to increase. It was even fortunate if they did not actually suppress all initiative.

In the 2nd Branch of the Ministry, various methods have been adopted for increasing output. Members of the staff are given books that will be valuable to them from the point of view of their administrative and technical instruction. Among these may be mentioned. FAVOL'S "Administration industrielle et générale" — MARDEN'S "L'employé modèle" — LECENSIER'S, "Le bon sens" — Dr. LAUR'S, "Une politique agraire suisse" — "Mon Bureau" (a French review), etc.

In addition, the staff were invited to make full use of the central library of the Department, an invitation which was warmly accepted. A chart which was exhibited in the library and is reproduced here shows that the issues of new books and reviews increased from 7075 in 1920, to 11,509 in 1921 (fig. I, p. 617).

The Minister, Baron RUZETTE, in his determination to increase the efficiency of his staff, arranged for their benefit a course of agricultural administrative law and accountancy.

Promotion to the higher appointments which formerly fell to a senior member of the staff, will in the future be given only to such officials as have shown distinct evidence of knowledge and capacity.

With this object in view, an examination of the candidates for the grade of Chief of Section has been organised.

CO-ORDINATION. — In order to secure unity in action and control, and to avoid overlapping and waste of energy, the Chief of the Department holds a meeting of his colleagues every time that important problems come up for solution, or a new principle is introduced. In this way the system of water tight compartments which was so highly favoured in old time offices disappears.

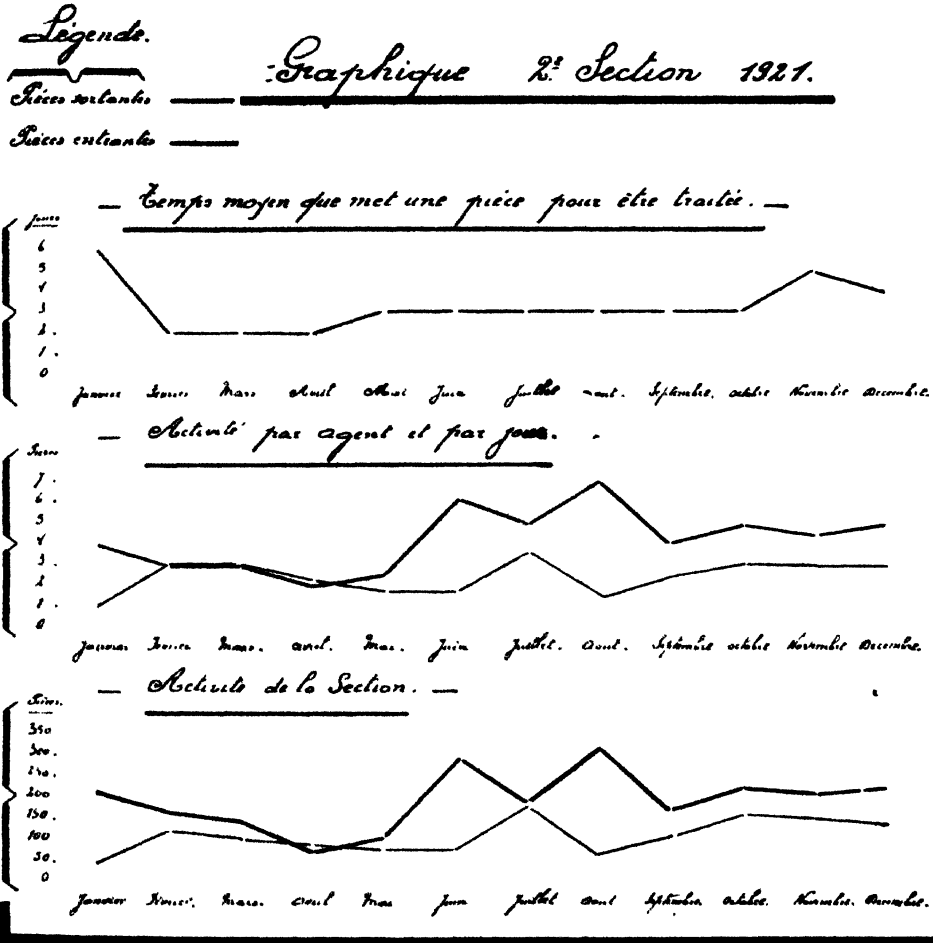


FIG. 4. — Work done by the central administrative Staff.

Apart from these occasional meetings, the Director General holds a conference at the beginning of each quarter, in his own office, in which all members of the staff without distinction take part; each is invited in turn to give an oral description of his personal share in the work and the points which he considers to be his special province. He calls attention to any shortcomings which he has noted and the reforms which should be

adopted. Similar reunions have been organised in the provinces for the members of the external staff.

**CONTROL.** — Administrative checks on the work of the different officials and services, both at the Central Office and outside, are chiefly carried out by means of charts, diagrams and graphs. By this means it is possible to obtain at a glance, without recourse to ponderous and often dusty files, an idea of the position of any given question, the points upon which activity has been specially concentrated and points that may require attention in the future. In this way, and very simply, practical effect is given to a favourite maxim of Napoleon's: "A simple sketch tells me more than a report."

These charts are of very special interest. To quote some of the most striking, fig. 2 (p. 618), shows the share of the Agricultural Budget in the General Budget for the country in 1921: viz. 23 million francs out of 3 802 million, or barely the 150th part, a share which is obviously too small when one considers the encouragement that should be given to agricultural production whose importance is higher than that of all the other industries taken together.

Fig. 2 shows also the marked disproportion which exists between the sums voted for agricultural and industrial instruction respectively: viz. 3 630 000 francs. Herein lies the explanation of the fact that industrial instruction which is the more highly favoured, is about to be substituted for agricultural instruction in several of the "écoles libres", i. e. "non-provided schools", (fig. 2, p. 618).

A third chart shows the position of intermediate agricultural and technical instruction in 1910 and 1921 (fig. 3, p. 619).

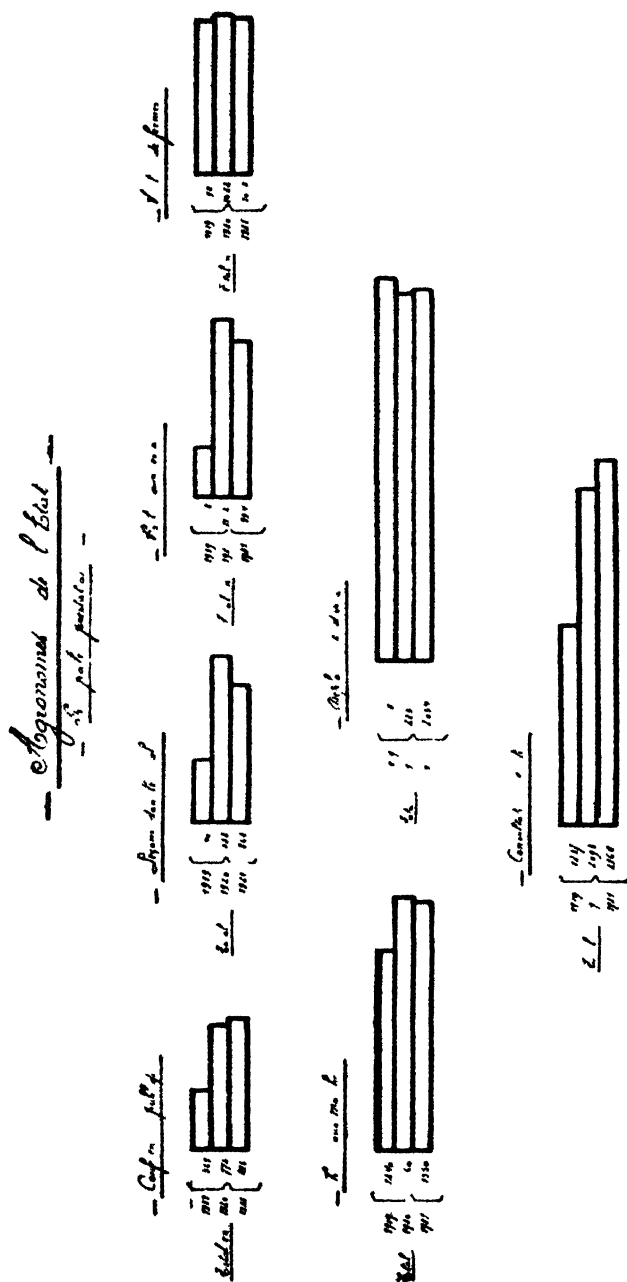
Figure 4 (p. 621) refers to the work of the staff at the central office. It shows, month by month, the average time required for the completion of a special task, the output per man and per day, and also of the section as a whole.

The diagram that deals with the State agricultural officers shows for each individual, in descending order, the number of meetings held, lessons given in schools, letters of advice to farmers, temporary courses started, and schemes of propaganda carried out. (fig. 5, p. 623).

From this instructive diagram it is possible to estimate the work performed by each individual and this information when completed by inspector's reports, makes it possible to estimate the value of each man's work. It may be noted in passing that since the establishment of this form of check the output has been nearly doubled.

Another diagram which refers to the work carried out by the women advisers on rural household science, shows at a glance the progress made in 1921 (fig. 6, p. 624).

There is also a wall map of Belgium showing the various places visited by the agricultural staff in the space of twelve months. As they are bound by their instructions to visit each commune in their district at least once a year it is easy to see how far these instructions have been carried out.





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SECOND PART  
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A B S T R A C T S

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AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

- 534 - **Opening of an Autumn School for Shepherds at Rambouillet, France.** —  
FALCON, P, in *Comptes rendus de l'Académie d'Agriculture de France*, vol VIII, No. 5,  
pp 107-111 Paris, Feb. 1 1922.

AGRICULTURAL  
INSTRUCTION

In accordance with a scheme prepared by MM. DECHAMBRE, MOUSSU and the author, the Academy of Agriculture ("Académie d'Agriculture") issued in 1920 the following recommendations for the improvement of the head of sheep:

1) Concessions of several thousand hectares should be made to colonists for sheep-rearing in North or West Africa.

2) One or more institutions for the technical study of sheep-rearing should be founded in France and North Africa: for instance in France at Rambouillet, for theoretical study: in North Africa on large holdings for practical work.

These recommendations are about to be realised, and the North African colonies to which they had been sent, have accepted them in principle.

By a decree dated 30th December 1921, the Ministry of Agriculture has decided to found a seasonal school for shepherds, as an annexe to the National Sheep Farm at Rambouillet. The period of instruction has been fixed at 14 weeks, from September 15th to December 25th for each year; half the period to be devoted to study and the other half to practical work on the sheep-farm. The pupils, who should have attained the age of 17, and have had some experience in agriculture, will be admitted after an examination on the subjects covered by the elementary school certificate. The subjects taught will include elementary French and arithmetic; a course of zootechnics as relating to sheep, a course in veterinary medicine, dealing especially with the ailments of sheep and a course in wood-working.

The staff of the school includes the Director, the accountant and the master shepherd of the Farm, whose respective duties are: superintendence, instruction in French and arithmetic, and practical work; a veterinary

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surgeon or superintendent of studies or assistant from the Veterinary School of Alfort who will give instruction in veterinary science, and a headworkman who will be in charge of the manual training in woodwork.

F. D.

AGRICULTURAL  
RESEARCH

535 - The Botanical Station at Maison Carrée in Algeria.— TRABUT, L. and MARIE, R., in *Revue de Botanique appliquée et d'Agriculture coloniale*, Year II, No. 7, pp. 86-92. Paris, 31st March 1922.

The Botanical Station was transferred from Rouiba to Maison-Carrée in 1906. The former Station at Rouiba, founded in 1894, was utilised for ampelography and viticulture. The Botanical Station covers an area of 18 hectares. It serves as a experiment field for botanical research as applied to agriculture in North Africa. The research work is under the direction by the Botanical Department of the Central Government. The branches of enquiry followed for the last 20 years include : the introduction of useful plants ; production of new forms by crossing and selection ; testing of plants produced or introduced ; improvement of plants obtained for cultural experiments or scientific research. Experimental farms receive the plants obtained and control results by extensive culture, increase the seed output and facilitate propagation.

Every year about 100 *cereals* are sown, hybridised and selections made, among the chief objects being to strengthen resistance to rust.

The number of *forage plants* is considerable. A large number of varieties of *Medicago sativa* show very different qualities. A species of lucerne from Peru makes growth a month later in autumn, and also a month earlier in spring ; for the district along the coast with a mild winter, it seems possible to obtain a perennial or almost perennial variety. After a study of the *Medicago sativa* the Director of the Station has come to the conclusion that this cultivated variety is a hybrid between *Medicago gretula*, which grows wild in North Africa and *M. falcata*. A special feature in the wild variety is its capacity for producing rhizomes branching out from the central root ; this wild lucerne crosses readily with the cultivated variety, the results being very varied and better able to resist drought, especially in the plains. The Gramineae studied are numerous ; among the native varieties, *Phalaris* take a prominent place. A hybrid of *Phalaris nodosa*, probably a cross with *Ph. truncata*, has been named *Ph. stenoptera* Hackel ; it makes an excellent winter feed, its growth is remarkable and it affords excellent pasture and lives longer whereas the other varieties are very early affected by rust.

The Station has drawn attention to an annual and non spreading variety of the Aleppo sorghum which, under the name of " Soudan Grass ", has become a summer feed. This Graminea has been called *Holcus exiguus* by Forskall, and two varieties are cultivated : the typical and the large Soudan variety as classified by HACKEL (*Monogr. Phan.* p. 504). The first has been named " Tunis grass " by the Americans, who received it from the Botanical Station and confused Tunis with Algiers, the second, " Soudan Grass ". The botanical description of this sorghum is merely



a variety of the Aleppo sorghum, but the Aleppo sorghum is a pest among crops, whereas the small sorghum is an excellent forage plant. The Station has introduced and is growing *Pennisetum purpureum* ("Elephant Grass", "Napier Grass") from Rhodesia, a prolific feed forage plant, and *P. Meskeri*, a similar variety more resistant to drought. Japanese *Mischanthus condensatus* Hackel gives a plentiful forage yield on the experimental ground at "White Farm" in a salty soil. The small Japanese sugarcane on the same farm has yielded 140 tons of green fodder per hectare. The *Saccharum biflorum* of FORSKALL does very well for fixing extensive dunes or forests in the department of Oran.

The numerous varieties of *Trifolium alexandrinum* have been studied, and as a result of experiment a variety has been produced which is resistant to a fall in temperature below 9°, and is to-day extensively and profitably grown in North Africa.

A native Melilot classed by POMEL as *Melilotus macrostachys*, belonging to the Gussone *M. inestans* variety and identical with *M. segetalis* Brot. fl. lus. has been grown as an excellent winter feed or as a green manure for orangeries, especially those on clay soil.

Commercial varieties such as tobacco, cotton, sisal-hemp and feverfew (Spanish camomile) have been largely tested.

Since 1907, when phylloxera was noticed at Algiers, American *Vitis* has been sown especially the two varieties: *V. Berlandieri* and *V. Doaniana*.

Fruit growing is extensively carried on and there is an important plantation of fig-trees. Caprifigation has been closely studied and research work into the origin of the *Ficus Carica* is in progress.

The principal varieties of the olive-tree have been collected; they will shortly be transplanted to a special station for olive culture in favourable surroundings.

Ever since the Station was opened, research in various directions has been carried on in connection with *Citrus* and the Station has introduced the principal species and varieties for comparative study. Numerous hybrids have been produced or studied. Research work has also been done on varieties suitable for grafting.

The Japanese medlar is well represented by the varieties introduced from Japan and America and by new growths.

Numerous varieties of *Diospyrus Kaki*, *D. sinensis*, and *D. virginiana* are being studied.

*Psidium* is also represented by several productive species.

Among the *Prunus*, numerous varieties of the Japanese *P. triflora* should be mentioned, and of hybrids which find the Algerian climate very favourable; these trees, which were first introduced in 1895, are beginning to yield fine fruit, which is on sale in the principal markets of the colony and fetches a high price.

The genus *Pyrus* is largely represented by the principal wild Asiatic and European species. An important collection of cultivated varieties, mostly from the South of Europe (Portugal, Spain, Italy, Greece) has been formed.

*Malus* also provides an interesting series of Asiatic and American species and cultivated varieties.

The introduction of the Chinese *Persica Davidiana* has furnished an excellent peach-stock for grafting. The tree attains a large size at the Station and is free from gum.

A considerable area is devoted to *Opuntia*; the varieties include some bearing very good fruit with small stony seeds and others useful as forage.

The pecan (*Carya olivaeformis*) which is highly spoken of by the Station, has developed well in a rather poor clay soil; graftings have been made of the best varieties of large fruit bearers recently produced.

Forest arboriculture is represented by a collection of willows for tanning; *Salix Humboldtiana*, a very fine tree and well acclimatised, may be mentioned; poplars are also to the front, especially DODGE'S *Populus pekinensis*, which has already been reproduced. A Mexican ash (*Fraxinus Berlandierana*) shows extraordinary growth and is in leaf all the year round. *Melia Azedarach* var *umbraculifera* is also noteworthy. One of the most interesting trees is the "tipa" (*Tipuana Tipu*) from Argentina with rapid growth and dense foliage, somewhat resembling that of the *Robinia* and equal to lucerne as a feed for herbivorous animals. The *Zelkows*, the *Ulmus* and the *Celtis* form interesting groups. *Morus* is represented by the Japanese *Morus Kagaya*, a very fine tree. Finally, the authors call attention to a certain number of hybrid *Eucalyptus*:  $\times E. Trabuttii$  Vilm. (*botryoides*  $\times$  *rostrata* Trab.),  $\times E. algeriensis$  Trab. (*rostrata*  $\times$  *rudis*),  $\times E. gomphocornuta$  Trab., etc.

Similar research work is also being carried on in connection with garden crops and an important collection of artichokes has been obtained from seeds of South Italian varieties.

G. A. B.

536 - The Forest Research Station in Denmark. - OPPERMANN, A., in *Det Forstlige Forsøgsvæsen i Danmark*, vol V, No 5, pp 391-421, 10 figs. Copenhagen, 1921.

During the period 1917-1921 (inclusive), the Department of Forest Research (1) has been entering on a new stage of development and has been re-organised on a wider basis. Thus in 1917 the post of Director became a permanent office and the staff of the station was increased. In 1921 an assistant botanist was engaged. In 1918-1919 the laboratory was established in specially built premises, to which lodgings for the Director and a steward are attached.

The Research Station possesses a nursery and a plantation; the total area covered by the Station and buildings is 5 hectares. Numerous experiments with various species of trees have been made and at the present time a number are being carried on in the nursery on different species of ordinary Danish forest-trees, as also on foreign species which seem likely to become of importance to the country. Other experiments are also being made with a view to discovering the efficacy of various forestry methods. A large number of young plants have been sent out for trial to the forest regions in different parts of Denmark.

(1) See R. 1917, No. 618. (Ed.)

On the death of Professor A. BÜHLER in 1920, the funds raised for the publication of an international bibliography on forestry, amounting to 11 422 marks, deposited at the "Wurtembergische Vereinsbank" and Tubingue, were transferred into the name of the author. G. A. B.

537 - **Two Cider-making Stations: The Fermentation Laboratory and Central Cider Brewery at Ettelbrück (Grand Duchy of Luxemburg).** — *Communicated by WAGNER, J PH President of the Société nationale d'arboriculture fruitière et d'horticulure at Ettelbrück and correspondin, member of L'Academie d'Agriculture de France*

The Fermentation Laboratory attached to Ettelbrück Agronomical Station was founded in 1899 mainly for research work on the most rational and simple processes of preparing good quality beverages from native fruits, by means of selected yeasts.

To facilitate as much as possible the use of these yeasts the laboratory is engaged each year in the culture on a large scale of selected yeasts during harvest-time and the subsequent period when the crops are being treated. The yeasts are supplied to the brewers, and merely have to be added to the musts, in the proportion of 1 litre per hectolitre, care being taken to follow the instructions, given in each parcel. The yeasts are sent in tins with a double safety-lid; this precaution is necessary because the yeast at the time of dispatch is in a high state of fermentation.

The quantities sent out increase from year to year, and have averaged from 4000 to 5000 litres for the last 10 years. This continual increase proves undoubtedly that the use of selected yeasts is really more advantageous than the old method. These yeasts undoubtedly make it possible to obtain excellent beverages, fermented quickly and regularly and keeping well.

For several years the Luxemburg fruit distilleries have also preferred to use these yeasts, experience having shown that they produce a high degree of fermentation and that the brandies thus obtained are superior, both in quality and quantity, to those made in the ordinary way.

The yeasts are in such demand for wine-making cider-making, and fruit-distilling, that when the vintage and fruit-harvest are at their height, the fermentation laboratory is scarcely able to satisfy the demands made upon it. The price of the yeasts 0 70 frs. per litre is quite moderate, so that it is within the means of all. In order to extend the use of cider among all classes of the population, members of the Arboricultural and Horticultural Society are supplied with these yeasts at a reduction of 50 % below the ordinary price, the society's funds being debited with the difference.

Before being sold to the public, the yeasts are proved in the testing-cellars of the fermentation laboratory where their properties and action are carefully studied.

In order to place within general reach the knowledge necessary for the proper utilisation of yeasts in wine and cider-making and distilling, the Government has organised special courses at the School of Agriculture, as well as conferences which are held on request by agricultural societies, arboricultural societies, etc.

As cider-making in Luxemburg was formerly much neglected and

carried out in a most rudimentary and defective manner, it was decided, with a view to encouraging the use of good cider, to make from part of the plentiful crops of roadside and other apples, a beverage that would really deserve the name of "Golden Drink". For as WARCOLLIER said in his report on "Apple Industries" ("Les Industries de la Pomme"), "the best way to render apple-crops valuable is to try to increase the consumption of cider and there is only one way of doing this, and that is, to make good cider. Cider should be a really commercial product, in other words it should be of good standard quality, keep well, be easily transported, and made to suit the taste of the customer. The number of people who would drink cider is everywhere great, but good qualities of cider are still too scarce."

The people of Luxemburg have therefore acted in full agreement with the opinion of this well known specialist in French cider-making, in founding a model establishment for this industry in close association with the scheme for the cultivation and diffusion of selected yeasts, and the encouragement of the use of good cider among all classes of the people. This establishment produces for its members 25 litres of cider ready for use from every hl of apples supplied, after fermentation and racking. It was established in 1909, through the efforts of the Luxemburg Society for the Cultivation of Fruit-trees and Horticulture and with the help of the State. It is entitled "The Central Cider-making Establishment of the Arboricultural and Horticultural Society" and has its headquarters at Ettelbrück, near the Fermentation Laboratory. The cost of installation was largely met by the State, for it renders considerable public service in the economical and proper utilisation of the fruit grown in the country.

The cider is sent to members in barrels belonging to the Establishment; the bad condition of barrels belonging to private consumers is really in most cases one of the chief causes of deterioration. The barrels of the Central Brewery are perfectly clean and free from all mustiness, etc. They are supplied free of charge to customers and must be returned in good condition.

Members of the Society have up to the present been charged a very moderate sum for the manufacture of the cider, varying for a long time from 5 to 10 centimes per litre. Owing to the increased cost of labour, the price has recently been raised to 25 centimes per litre. If the increased price of raw material be added, the Brewery can scarcely sell the cider it makes on its own account for less than 100 fcs. per hl. In addition to the cider supplied to members in exchange for their apples, is also brewed a certain quantity for members who have no fruit of their own but desire a first-class quality of cider. The small profit thus realised helps to defray part of the expenses.

The central building, where 5 or 6 persons are working during the season from October to December, and a cellar man all the year round, contains a large stock of barrels and other accessories and 7 large presses, one of which is hydraulic. This press and the crushers are worked by two electric motors.

Since 1909-1910, the Central Brewery has produced 35 000 hl. of cider for its members. It was not working during the war.

Results have shown that both the Fermentation Laboratory and the Brewery have done great service for the diffusion of a knowledge of the proper way to prepare cider and have thus fully achieved the purpose for which they were established.

No profit is realised on the Brewery and none was anticipated.

This modest co-operative undertaking is altogether different from the large cider-breweries in the cider-producing districts, as for instance, in France. There, the commercial and economic aspect is of chief importance, in the Luxembourg Establishment, on the contrary, the commercial element is left entirely out of the question and only its social and national sides are considered.

To encourage the consumption of cider its production must be made easy. Many people with or without stocks of apples would undoubtedly drink cider if they had the time, the knowledge of the necessary appliances for making, treating and preserving it but when these are absent other beverages will be used. It is precisely for such persons that the Luxembourg Horticultural and Arboricultural Society with its Central Brewery has been founded.

For the same reason it should likewise serve as a school where everyone may come and learn by seeing in practice how this wholesome beverage should be produced, treated and preserved. There would be little need of such an establishment in countries or districts where the use of cider has for centuries been habitual among the population but it may serve as an example of useful and effective propaganda and publicity.

538 - Accuracy in Experiments carried out at the Danish State Experiment Stations with Varieties and Strains of Roots. - KRISTENSEN R. K. *Udskrift for Planteavl*, Vol. XXVIII, Part 1 pp. 110-128. Copenhagen 1922.

The object of the investigation was to determine the accuracy of the experiments made at the State Experiment Stations since their foundation in comparing different varieties and strains of roots. The investigation is based on material from the experiments of 34 years and includes the results of 5014 experiments. As these results are complicated by both chance and systematic deviations, the author has worked out a special method for eliminating the systematic deviation which does not appear as an error in the experiment, and the standard deviation expressing the experimental error is computed according to a special formula based on this method (1). The experiments were made with mangolds, swedes, turnips and carrots.

(1)  $m = \sqrt{\frac{\sum (v^2)}{[p-2] (n-1)}}$  where  $m$  is the standard deviation,  $\sum (v^2)$  the sum of the squares of single deviations,  $p$  the number of varieties, and  $n$  that of places. See KRISTENSEN, R. K., *Bestemmelse af Middelfejlen ved Kombinationen af ensidige og tilfældige Afvigelser*, *Udskrift for Planteavl* XXVIII. 1. 110-128. 1922. (1 d)

and are divided into 4 groups : I) Experiments, with varieties, 1886-1893 ; II) Preliminary experiments with strains, 1894-1899 ; III) One-year experiments with strains, 1900-1910 ; IV) Three-year experiments with strains, 1911-1919.

The experiments with mangolds were the most comprehensive. The standard deviation in the final results in these experiments, expressed in percentage of the crop was : I) 3.15 % ; II) 2.41 % ; III) 1.67 % ; IV) 0.92 %.

The constant regular decrease in the standard deviation from one group to another expresses the constant improvement in experimental methods. In the last group, the three-year experiments from 1911-1919, the standard deviation (compared with the average crop of the kind of roots in question) was :

	100 kg. dry matter per ha.	Standard Deviation	
		100 kg.	%
Mangolds . . . . .	85.6	0.79	0.92
Swedes . . . . .	79.6	0.79	0.99
Turnips . . . . .	51.7	0.73	1.41
Carrots . . . . .	66.1	1.45	2.19

The reason for the comparatively high standard deviation in the experiments with carrots may, among other causes, be found in the fact that the experiments with this root are in the main carried out on light, sandy soil where the crops are especially susceptible to the possibilities of drought, and where sand-drift sometimes occurs

G. A. B.

## CROPS AND CULTIVATION

### AGRICULTURAL METEOROLOGY

539 - Influence of Temperature and Rains on the Maize Yield in Argentina. ---  
HIESLING, N. A. in *Monthly Weather Review*, v 49, No. 10, pp. 543-548, Washington  
Oct. 1921.

Of all the factors which determine annual variations in crop yields, atmospheric changes are undoubtedly the most important, and among these the rainfall takes first place. The author, after referring to investigations already undertaken in the United States on the meteorologico-agricultural problem of maize, gives the results of experiments carried out by himself on this plant in Argentina with the object of ascertaining the influence of rainfall and temperature on its yield.

In calculating the correlation coefficients for yield, total rainfall and temperature in the different months, the author has obtained the figures set out in the following table :

*Correlation coefficients for maize yield, rainfall and temperature  
for each month of the growth period.*

	Rainfall	Temperature
October. . . . .	0.46	— 0.49
November. . . . .	0.45	— 0.47
December. . . . .	0.52	— 0.35
January . . . . .	0.46	— 0.61
February . . . . .	0.04	— 0.28
October to January	0.71	— 0.64

An examination of this table shows that the yield is to a large extent dependent on the rains of the period from October to January, and in negative correlation with the average temperature for the same period. In February, the rains no longer seem to have any influence and the effect of the temperature is accentuated the higher it is, the scarcer the yield. The effect of the rainfall for each of these months is about equal, whereas the temperature has a much greater influence in January.

On the whole, the plentiful years are those in which the rainfall is more abundant, and in those years in which the yield is poor the rainfall is correspondingly slight. On the other hand, the increase in yield is not in proportion to that of the rainfall: the yield is considerable for the first 300 millimetres, then it gradually diminishes to a maximum beyond which the effect of the rains becomes negative

G. A.

540 - **Influence of Rain on the Hay-Crop of Certain Forage-grasses at Svalöf, Sweden.** — WITTE H, in *Sveriges Utsädesföremåns Tidskrift*, year XXXII, vol I, pp 21-57 Malmö, 1922.

Among the local agrogeological and meteorological conditions which have an influence on the growth of forage-grasses, the rains are undoubtedly the most important.

In this connection, this article gives the results of an investigation of the relation between the rainfall and the hay-crop of the following species: *Phleum pratense*, *Dactylis glomerata*, *Festuca pratensis* and *Avena elatior*.

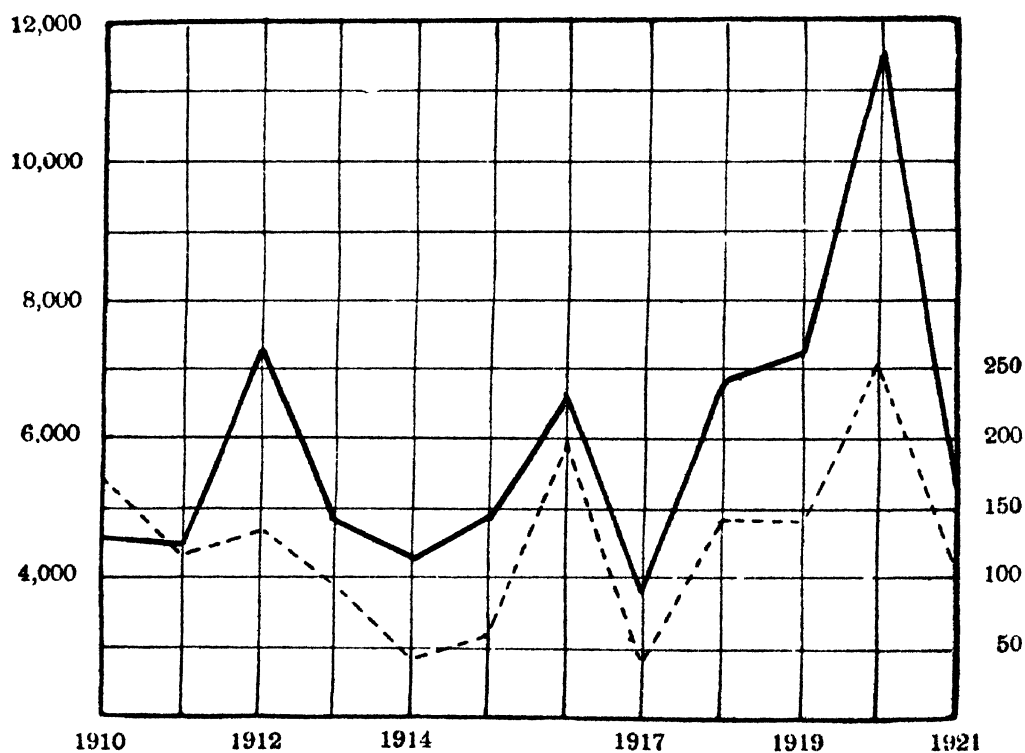
The author has ascertained that the most beneficial rains are those which fall from the 16th April until the first cutting. The length of this period varies according to the temperature conditions and the particular species of grass

The following are the figures in the present case.

<i>Dactylis glomerata</i> . . . . .	from 53 to 75 days
<i>Avena elatior</i> . . . . .	» 51 » 80 »
<i>Festuca pratensis</i> . . . . .	» 51 » 82 »
<i>Phleum pratense</i> . . . . .	» 67 » 100 »

The results of the examination are shown in full in tables setting out the yield of these gramineae (the first cutting and aftermath) for the first and second years and also various data on the total rainfall and the number of days in each month and for different group of months on which rain fell. In table XI here reproduced are shown the total rainfall from 16th April till the first cutting, the number of rainy days for the same period and the yield in hay in kg per ha., for each species during the period 1910-1921. It proves conclusively that there is a positive connection between rainfall and crop, as will be seen at a glance from the diagram relating to *Phleum pratense*.

*Relation between rainfall and hay crop of Phleum.*



EXPLANATION :

*Ordinates* Yield in thousand of kg per hectare

*Abscissa* Year under consideration

— Hay yield per ha

- - Rainfall in mm (from 16th April till first harvest)



This connection becomes still clearer if one compares the averages for the years with similar rainfall

Group I year with slight rainfall

Group II " " medium "

Group III " " heavy "

Following the above classification we have for early gramineae

Group I 1914, 1917, 1918 and 1921 average rainfall 30 mm, number of rainy days, 11

Group II 1911, 1913 and 1915, average rainfall 65 mm, number of rainy days, 15

Group III 1910, 1912, 1916 and 1920, average rainfall 143 mm, number of rainy days, 27

and for *Phleum*

Group I 1914, 1915 and 1917, average rainfall 41 mm, number of rainy days, 16

Group II 1911, 1912, 1913 and 1921, average rainfall 112 mm, number of rainy days, 25.

Group III 1910, 1916, 1918, 1919 and 1920, average rainfall 177 mm, number of rainy days 37

A year which is dry for the early gramineae may, on the contrary, be wet for *Phleum* in consequence of the rains which fall between the two cuttings. Thus, in 1918, *Phleum* had a rainfall of 130 mm more than the early species, and yielded, on an average 70 % more (83 % in the case of *Dactylis glomerata*)

The tables which follow show as might have been expected that *Avena elatior* gives the best yield in dry years and the increase of this yield concurrently with a heavier rainfall is lower in proportion to that of the remaining three

The figures in the second table relate to the first cutting, reckoning the yield in dry years as 100

#### Yield in kg per ha

	Group I	Group II	Group III
1st year.			
<i>Dactylis glomerata</i>	3 910	5 640	6 610
<i>Festuca pratensis</i>	4 570	7 200	8 610
<i>Avena elatior</i>	5 200	7 310	7 940
<i>Phleum pratense</i>	4 350	5 510	7 320
2nd year			
<i>Dactylis glomerata</i>	2 680	4 800	5 840
<i>Festuca pratensis</i>	2 610	4 690	6 010
<i>Avena elatior</i>	4 120	5 760	7 560
<i>Phleum pratense</i>	2 860	5 570	5 850

There is also undoubtedly a direct connection between the yield of the aftermath and the rainfall, but it is not very easy to give the figures. The author has shown the rainfall for different periods (total fall between

Yield of the first mowing as compared with the rainfall and number of rainy days during the period from 16th April until the first cutting (Svalof, 1910-1921).

	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921
<i>Phleum pratense</i> :												
Rainfall in mm. from 16th April	172.9	120.6	128.3	99.5	47.5	57.3	199.5	40.6	145.6	145.1	222.7	109.0
Number of rainy days.	36	29	29	22	21	17	37	10	34	34	45	22
Hay yield, kg. per ha.	4600	4510	7300	4800	4320	4890	6500	3840	6820	7140	11460	5430
<i>Dactylis glomerata</i> :												
Rainfall in mm. from 16th April	104.8	57.2	94.0	76.0	41.8	60.3	143.7	29.6	14.5	87.0	200.7	31.3
Number of rainy days	23	17	22	12	15	16	23	7	10	20	40	12
Hay yield, kg. per ha.	5130	5660	7940	6190	5250	5080	5660	4050	3730	5560	8750	2600
<i>Festuca pratensis</i> :												
Rainfall in mm. from 16th April	113.0	59.9	138.0	77.0	42.8	60.3	172.4	29.6	15.1	104.0	200.7	31.3
Number of rainy days.	24	19	29	12	16	16	27	7	11	22	40	12
Hay yield, kg. per ha.	7200	7920	9450	7590	5390	6100	7180	4830	4290	6840	12390	3780
<i>Avena elatior</i> :												
Rainfall in mm. from 16th April.	104.8	58.9	138.0	77.0	46.8	60.3	145.5	29.6	13.5	104.0	200.7	31.3
Number of rainy days.	23	17	29	12	17	16	24	7	10	22	40	12
Hay yield, kg. per ha.	8220	8200	9180	7860	5310	5880	7620	4530	4200	536	9310	6760

the first and second cuttings ' for a period of 40 days after the first cutting ; for the fortnight before the first cutting , and for the fortnight or 30 days after the first cutting) together with the corresponding forage yield.

	Group I	Group II	Group III
<i>Dactylis glomerata</i>	100	158	189
<i>Festuca pratensis</i>	100	166	204
<i>Avena elatior</i>	100	140	166
<i>Phleum pratense</i>	100	154	179

The figures thus collected and classified, bring out, in spite of numerous exceptions, a connection between the yield of the aftermath and the rainfall at the time the first cutting both before and after. Much remains to be done before the problem can be finally solved, including experimental tests for a long series of years made under identical agrogeological conditions, careful attention being paid to all the conditions which may have any bearing on the question. G A

511 **Present Phase of Protection against Frost by means of Fumigation in the "Grand Valley" of Colorado.** — HARRICK, M. in *Monthly Weather Review* vol 17, No 1 pp 51-55 Washington Oct 1911

Ten years ago the Grand Valley of Colorado had become the centre for 'Frost Control' in the fruit belt of the United States. The head of the meteorological department at Grand Junction devoted all his energy to the development of the weather forecast service and the results were transmitted with quite remarkable regularity and rapidity.

Hundreds of horticulturists were warned in time of coming frosts and thousands of dollars were spent yearly in 'warming' orchards. Labour and fuel were at that time rather cheap and the price of fruit was high, so that expense incurred in protecting orchards against bad weather was justified. The peach, apricot, pear and apple tree plantations from Vineland and Palisade to Loma and Garmesa were artificially warmed each time the forecast indicated a temperature much below zero.

But the growers did not all join in the scheme, some because they had not the means to buy the receptacles and fuel, others because they were averse from carrying out the somewhat complicated work involved and others again from pure scepticism as to the results. When the fruit was gathered the yield was practically the same both for the growers who had not adopted protective measures and for those who had, while the latter had incurred the enormous expense of fumigating their plantations. Then came the war and with it the increased price of labour and fuel without a corresponding increase in the selling price of fruit, the fumigations were abandoned for the most part and only continued for peaches, apricots and certain varieties of early pears at Palisade in the highest part of the Valley.

In 1921 the weather was exceptionally mild in January, February and March, and thus accelerated growth, so that by the 18th of March the apricot trees were in full blossom and peach-trees were beginning to bud. From the 24th of March, however, and during the whole of April, there was a return of severe cold and the temperature fell below zero (see following Table)

*Minimum temperature registered from March to May  
in some stations of the "Grand Valley"*

Stations	March	April	May	Stations	March	April	May
Clifton	—	— 5 00	2 78	Orchard Mesa	—	— 5 00	1 67
Fruita	— 7 22	— 8 33	1 11	Palisade	— 4 44	— 4 44	3 89
Fruitvale	— 6 67	— 3 89	1 67	Pomona	— 8 33	— 6 11	1 67
Hunter	— 7 78	— 6 11	2 22	Redlands	— 6 11	— 6 11	3 33
Loma	— 8 33	— 8 33	0 00	Grand Junction	— 2 22	— 2 22	3 33

Given the advanced stage of growth these temperatures should have had a most injurious effect, instead of which the fruit yield was really very good in 1921.

From an inspection made immediately after the spring frosts it was found that only 29 growers in the neighbourhood of Palisade had had recourse to the radiators after having received warning by telephone from the Weather Bureau of the fall in temperature.

In the lower part of the Valley where fumigation is no longer practised, the Stations at Loma, Hunter, Pomona, Redlands and Orchard Mesa which were no longer needed were suppressed.

In 1921, 900 wagons of Elberta peaches and 400 wagons of pears were gathered in the Grand Valley, whereas the low temperatures which prevailed during the flowering season should have completely destroyed the crops.

Instead of fumigation, the author believes that better results could be obtained by irrigation which encourages fogs and prevents excessive falls in temperature.

G A

512 — Clay as an Ampholyte (1). — ARRHENIUS, O. (Stockholm) in *Journal of the American Chemical Society* XLIV No 2 pp 521-524 1 fig. Easton Pa., Mar. 1921.

Soil physicists generally are aware that saline soils cause serious trouble during the filtration of extracts, and especially render the extracts cloudy or greyish. It is also known that alkaline substances tend to render the earth suspensions stable, whereas acids coagulate them. The proportion of deposit in earth suspensions is of great importance in the

(1) The so called ampholytes are amphoteric electrolytes, that is, those which contain the acid and basic groups and which consequently have at the same time an acid and a basic reaction. (1')

mechanical analyses of soils, and authorities do not agree on this subject, especially as regards the addition of bases or acids. Probably, the actual acidity of the suspension, that is, the hydrogen-ion concentration, is the most important factor, rather than the quantity of acids or alcohols added. It is not surprising therefore that the various writers on the subject have not found a satisfactory explanation of this phenomenon. Indeed, the idea of the restrictive action of the soil towards the changes of reaction is too recent, and it is only when this possible relation is considered that the fact that certain soils show a remarkable change of reaction and others do not, when the same quantity of acid is added, can be explained.

To verify the influence of hydrogen ion concentration as compared with the quantity of alkalis or acids added, the author has made an experiment with two clay soils: one, brick earth with a 7.5 exponent of  $P_H$  acidity (1), the other, a peat-soil, with a 5 exponent; he placed them in suspension and added equal parts of acid and alkali, shaking, and allowing a deposit to form; after a certain time the column of clear liquid was determined by registering the number of cubic centimetres per hour. A similar action results from the data obtained in an acid medium, first a decrease in the quantity of deposit is noticed, then suddenly an increase up to a maximum is reached at the isoelectric point, that is to say, the point of least solubility; on the contrary, in an alkaline reaction, that is, with a weaker hydrogen-ion concentration, the suspension is always more stable, with a minimum deposit, after which, a high degree of alkalinity having been reached, there is again a decided increase of deposit.

The same rules, therefore, may be applied to the mineral ampholytes of the soil as LOEB (*J. Gén. Phys.*, 1920, 1921) proposed for organic ampholytes in relation to bases and acids, with which they combine in stoichiometric, that is, chemically fixed proportions, which revolutionises current ideas on the soil and its condition. The terms applied to absorption in colloidal chemistry must therefore be set aside, since the physico-chemical laws also apply, as is seen, simply to colloid minerals and, consequently to the soil; the word "colloid" should therefore be used only to indicate a particle with special dimensions but not with special properties.

To sum up, clays of different origin and varying reaction have the same isoelectric point, that is, they coagulate in suspension at the same degree of acidity, and the curve obtained for the speed of deposit as compared with the hydrogen-ion concentration has the same inclination as that of gelatine. Clay therefore acts as an amphoteric electrolyte, which can combine either with acids or bases, as is confirmed by the buffer action exercised by the clays themselves; this result is both of theoretical and practical importance.

G. A. B.

(1) For the definition of this exponent, see note to R. Feb 1919, No 150 (*Ed.*)

543 - Partial Sterilisation of the Soil by means of Arseniate of Soda. — RIVIÈRE, G. and PICHARD, in *Journal de la Société Nationale d'Horticulture de France*, 4th Series, vol XXVIII, pp 141 142 Paris, March 1922

Before the war, at the Agronomical Station of Seine-et-Oise, where their work is now being continued, the authors had already started experiments on the partial sterilisation of the soil by means of different antiseptic salts, especially arseniate of soda, they have also observed the indirect beneficial action which this salt exercises by destroying bacteriophagous protozoa. They have obtained the following results on a culture of potatoes

Treatment	Yield per ha
Untreated	14 200 kg.
20 kg. of arseniate of soda per ha	16 200 kg.
30 kg	16 740 kg

It follows that arseniate of soda used in small quantities has no injurious effect on vegetation, but that its toxic properties are still strong enough to kill the protozoa which destroy the useful bacteria. Like other volatile antiseptics (carbon bisulphide, toluene, formaline, etc), it has therefore an indirect fertilising action, for which reason, and also on account of its comparative cheapness, it may be used in practice for the partial sterilisation of the soil in order to obtain a better yield, without the necessity in the first instance, for the use of nitrogenous fertilisers. G A B

**MANURES  
AND  
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544 - Fertilisers in Spanish Agriculture. MINISTERIO DE FOMENTO, DIRECCION GENERAL DE AGRICULTURA, MINAS Y MONTEs, *Measures fertilizantes empleadas en la Agricultura, Resumen hecho por la Junta Consultiva Agronomica de las memorias de 1919 remitidas por los Intendentes del Servicio Agronomico provincial* pp 611. Madrid 1921

Summarised report of the Consultative Committee of the Spanish Ministry of "Fomento" (Agricultural Development), drawn up from the reports for the year 1919 and supplied by the Provincial Agricultural Engineers. The introduction is followed by information on the different provinces divided into 13 districts, for each province particulars are given as to the state of organic fertilisers, chemical or otherwise, as well as details as to the trade and manufacture, the report concludes with four summarised tables showing the unit consumption (per hectare) per province and per crop both of organic and residual fertilisers, and chemical manures, the number of hectares treated, the amount of fertilisers used, the cost per hectare and the total outlay in the different provinces, both for organic and residual as well as for chemical fertilisers.

In Spanish agriculture, in spite of the difficulties due to the special characteristics the use of organic fertilisers has been extended and improved, and the use of chemical fertilisers is of growing importance. The tests made by numerous experimental farms, the experience gained by numbers of farmers, the propaganda carried on by merchants, leaflets and

conferences, the campaigns of the agricultural press and other means of publicity have greatly contributed to the progress of the use of fertilisers in Spain. Much, however, still remains to be done before scientific research, testing and propaganda will enable further progress to be made in this branch of agricultural science and promote agricultural development by means of plant and seed selection and the use of motors. An enlightened interest in the fertilising trade and industry ought, it would seem, to do much to prevent fraud in the weight, quality and strength used; the cases reported have however necessitated State intervention for the protection of the buyer and the punishment of fraud. The inspection of chemical fertilisers comes under the Provincial Agronomical Service, and the Central Agronomical Station, the laboratories of the District Experimental Farms, the General Agricultural Stations and the Agronomical Divisional Organisations now exert a most salutary influence in this respect, which will be rendered still more effective by an improvement in organisation and staffing.

It is the duty of the Government, with the cooperation, of the people, to encourage the production of raw material for the manufacture of chemical fertilisers, and to support this industry within the country for the benefit of agriculture. Special attention should be given to the production of phosphates, for rich layers are known to exist in the south of Spain; these layers, being badly exploited, and means of transport insufficient, do not yield what they should, either as regards quantity or returns. It is desirable that three laboratories should be established in the most suitable localities for the exclusive study of chemical phosphatic nitrogenous and potassic fertilisers, their duty would be to collaborate in the necessary testing, propaganda and control, in the general interest of agriculture.

The tables contained in the report show that the total consumption of organic fertilisers and waste products (manure and other animal excrements, green fertilisers, sewage, human fertilisers, fish refuse, dry blood, bone powder, ashes, etc.) amounts to 330 608 498 qx, at a total cost of 46 1906 209 *pesetas* and the total area manured to 2 851 857 hectares, that is 115 qx per ha. The total quantity of chemical fertiliser used (superphosphates, basic slag, ammonia sulphate, nitrate of soda, cyanamide of calcium, nitrate of lime, potash, chloride of potassium, kainite, double salts, composite fertilisers) amounts to 11 366 136 qx at a cost of 357 809 759 *pesetas*, for a total area of 3 133 505 ha, or a unit of 3 62 qx per ha. The total quantity of fertilisers used in Spanish agriculture amounts to 341 974 634 qx, costing 819 806 058 *pesetas*. Among the organic fertilisers, the dung of horses, cows and swine naturally predominate: they total 309 038 334 qx of the value of 433 743 965 *pesetas*; the superphosphates are the most used of chemical fertilisers—5 594 836 qx, value 233 976 563 *pesetas*. The figures, taken in conjunction with the known fact that the two kinds of fertiliser are not used in sufficient quantities on all the land which needs them, or are not of sufficient strength, prove that it is necessary to increase the breeding of live-stock and also the manufacture and importation of phosphates.

G. A. B.

545 - **Inoculated Leguminous Plants as Nitrogenous Fertilisers.** — BROWN, P. E. and STALLINGS, J. G. (Iowa States College) in *Soil Science*, vol XII, No. 5, pp. 365-407, bibliogr of 46 works New Brunswick, N J, Nov 1921.

The discovery of symbiotic relations between leguminous plants and their radicular bacteria has thrown light on certain branches of agricultural practice, has led to new applications and has given rise to numerous problems which are now being examined or are on the way to solution. For instance it is now understood why leguminous plant culture is an equivalent for nitrogenous fertilising and an explanation is given of the beneficial effect produced by spreading earth taken from fields previously cultivated over newly broken ground sown with clover

Some very important practical applications have resulted *e. g.*; the method of inoculation by bacterial cultures, and the principle that, to obtain better results, the bacteria proper to each legume cultivated should be used for its inoculation. The problems now under examination are: cross-inoculation, the grouping of bacteria from different legumes into homogeneous families, the preparation of highly efficient or virulent cultures, the non-symbiotic nitrogen-fixing power of the bacteria, the relation between the symbiotic process and the nitrogen content of the soil, the period of the activity and vitality of nitrophagous bacteria and their isolation from the soil, such are some of the technical problems which at present are receiving most attention

Only a few exact data are at present available as to the quantity of nitrogen added to the soil by different legumes

Numerous and careful researches made under varying conditions would be very useful. At the present time one has to rely on hypotheses rather than precise data, for instance, it is considered probable that in districts rich in nitrogen, legumes take less from the air than those which are poor in nitrogen. Data are available as to the quantity of nitrogen stored in the roots of legumes and in their aerial parts, but still more are necessary for each kind of plant, the different soils, the agricultural operations carried on, etc. here also, practice is based on hypotheses and not on the results of scientific experiment. Only by further research will definite and complete information be obtained as to the continuous supply of nitrogen to the soil

To compensate in some measure for the present lack of knowledge on the subject, the authors have obtained from Anglo-Saxon agricultural literature a rich harvest of data relating to the symbiotic fixation of nitrogen. the results cover a wide range, both as regards the total storage of nitrogen and the relation between the quantities stored in the parts of the legume underground and those above ground, the divergencies are due to a great extent to the nature of the soil and culture. thus HOPKINS concludes that the roots of alfalfa contain as much as half the total quantity of nitrogen, those of the common clover only  $\frac{1}{3}$ , and those of soya and cowpea barely  $\frac{1}{10}$ ; these of course are only very rough averages and liable to considerable modification.

Preliminary researches have been made by the authors in two districts



in Wisconsin possessing very different characteristics, one being loam and the other sandy loam, the former ranges from a deep brown to black colour and is rich in humus and nitrogen, the latter is light in colour and poor in organic matter and nitrogen. Analyses showed respectively 0.2701 and 0.1353 %. Some samples of soil were not treated, others were inoculated, others again were first sterilised by autoclaving for 1 hour and then inoculated. Common clover and alfalfa were cultivated, each experiment was repeated in pots each containing about 4.5 kg. of earth; and the same number of plants was grown in each pot. The underground parts of the plants and those exposed to the air were weighed both in their green and dry state at various stages of their growth, and the nitrogen content of both the tops and roots was then determined by the KJELDAHL method and also the nitrogen content of the soil.

It is difficult to give the results because there were irregularities and wide divergencies. It may be said however, that on an average the clover roots weighed at maturity 36 % of the plant, those of alfalfa 53 %, the figures were a little higher at the blooming period than at maturity, they were also rather higher in soil which was poor in nitrogen and organic matter than in rich soil while they decreased in sterilised soil. In the richer soil the total growth of the plants was more vigorous but especially so as regards the tops.

Regarding the fixation of nitrogen each plant stored 15 to 25 cgm. if the soil was not treated. The alfalfa fixed more in poor soil the clover more in rich soil when sterilised and then inoculated. The quantity of nitrogen in the roots averaged 27 % for clover and 46 % for alfalfa. The nitrogen fixed came to a great extent from the air and not from the soil even in the case of the roots. This fact is important because it shows that even if the tops are taken away and the roots only left, there is a gain in nitrogen.

The sterilisation of the soil has an unfavourable effect where results are obtained from soils sterilised and not restored, they must therefore be considered as abnormal.

The non-symbiotic nitrification is also a disturbing element.

However no definite conclusions can be drawn or extended application made of what applies only to two legumes and two kinds of soil, it is probable that the results of the experiments have also been influenced by the culture being effected under glass, there is nothing to show that results would have been the same in the open. The experiments will serve mostly as a guide and it is desirable that they should be continued and extended.

I, V

546 - **Tobacco Refuse as a Fertiliser.** — See No. 634 of this *Review*.

517 - **Experiments with Potash Fertilisers in the United States.** — I SMITH, R. S. Some Effects of Potassium Salts on Soils, in *Cornell University Agricultural Experiment Station, Memoir* 35, pp. 571-605, bibliogr. Ithaca, N. Y., 1920. — II PARR, S. W. and AUSTIN, M. M., Potash Shales of Illinois, KREV, F., Geology Distribution, and Occurrence

of the Potash-Bearing Shale of Union County; STEWART, R., *Finely-Ground Shale as a Source of Potash for Soil Improvement*, in *University of Illinois Agricultural Experiment Station Bulletin*, No. 22, pp. 227-252, 5 figs Urbana, Ill., 1921.

I. — The data on the effect of potassium chloride and potassium sulphate as fertilising elements on the soil do not agree; and for this reason the first work quoted has been written. The problem consists first in determining the effect of different applications of potassium chloride and potassium sulphate on the growth of wheat, both in soils, treated, differently, and in the aqueous extract of these soils; next, in determining the causes of the effects of these salts on the growth of wheat, in connection with the statements of other writers. The soils used were of a sandy clay character, somewhat typical of an extensive zone in the United States, and of high, medium and low fertility. After being analysed, they were put into pots and then limed.

The potassium sulphate increased the growth of straw in the highly productive soil and had no injurious effect on the medium soil; on the other hand, the potassium chloride had a toxic action on wheat in rich soil when applied at the rate of 0.5 per 1000, and in medium soil there was a slight decrease in yield with an application of 1 per 1000.

In the extracts from rich soil, potassium chloride stimulated the root growth of young wheat plants with concentrations corresponding to applications of from 0 to 1.5 per 1000; the greatest stimulation was observed with a treatment equivalent to 0.25 per 1000. With potassium sulphate there was a progressive stimulation up to 1 per 1000, but at 1.5 per 1000 it became decidedly toxic. Among the extracts from medium soil, those untreated had a toxic action on the root-growth of young wheat plants; an application of 0.1 per 1000 of potassium chloride had the most stimulating effect; with stronger applications, diminished growth and apparent toxicity were observed; a 0.25 per 1000 treatment of potassium sulphate had the most stimulating effect, while this effect was also diminished and toxic properties were evident with stronger applications. In the extracts from very poor soil, not treated with lime there was clearly a toxic effect on the root growth after an application of 0.25 % of potassium salts, but the application of lime caused a diminution of toxicity, even with a maximum treatment of chloride.

In every case potassium chloride produces a smaller accumulation of nitrates, but this effect was checked by liming; on the other hand, potassium sulphate stimulated, or seemed to stimulate the accumulation of nitrates in rich and medium soils. A maximum dose of potassium chloride diminished the nitrification of the nitrogenous matters applied, whereas potassium sulphate had a stimulating effect, except in the case of the maximum application on rich soil; lime tends to lessen the depressive effect of potassium chloride in very poor soil, but without restoring it completely.

The author did not find iron or aluminium in any of the soil extracts, and in those from very poor soil even manganese was wanting; the injurious action of potassium salts therefore should not be attributed to the

restitution of iron, aluminium, or even manganese in the case of very poor soil ; on the other hand, potassium chloride and potassium sulphate actively replace calcium. There is less calcium than might be expected in the extracts of the series treated with sulphate, and this is probably due to the insolubility of calcium sulphate. Magnesium is replaced in a less degree than calcium ; manganese is replaced in appreciable quantities in rich soil, and particularly so in medium soil. Soils which contain a maximum of manganese soluble in water have the lowest nitrifying power, show the least vigorous growth in pot cultures and the poorest root growth in extracts.

The effect of potassium salts on plant growth is therefore due to a complexity of factors, including sometimes the direct action of the salts themselves on plant growth, sometimes the action of bases replaced by potassium and especially that of manganese ; and this is in agreement with the literature on the subject, a summary of which proves that ordinary potassium salts generally have an injurious effect on plant growth when used in large quantities, and that this effect should be attributed in part to the basic exchange, in which the composition of the soil is an important factor ; another factor is the decided modification of the bacterial activity of the soil.

II. — The shales of the South of Illinois were found to be rather rich in potash, 5 % and more ; their composition also favours the production of Portland cement to such an extent that in collecting the potash, 5.3 % could be extracted. These shales contain petroleum in a free state, bituminous matter, pyrites and undecomposed potash rock of a feldspathic nature, as well as potash material of a glauconite character ; another shale contains up to 5.8 % of potash, but in a less stable form.

The extraction of potash by means of reagent solids and liquids is impracticable on account of the high cost of lyes and their recovery. These shales seem to contain potash in an assimilable form and that which is soluble in sulphuric acid seems to be due to glauconite potash ; of 5 % of raw potash or 5.6 % after calcination, 62 % is glauconiferous and can be assimilated by plants. The situation of these strata is such as to render their exploitation easy.

Experiments with pot cultures under glass in turfy soil prove that the application of these shales, finely ground, has a decidedly beneficial effect on melilot, rape, maize-forage and buckwheat, as well as on wheat, in sandy clay soil, after a general lining, in comparison with kainite, natural and calcined alunite, and leucite, alone or with magnesium and sodium chlorides ; the results are of such importance that from the economic point of view they justify extensive research, especially on open ground, and should arouse public interest ; it is proved indeed that potash of these shales can be directly utilised by pot cultures under glass, and that they give better results than any other.

The foregoing experiments in pots, and also with turfy soil, have clearly shown the effect of leucite ; in comparison with untreated soil merely

limed the increases in hundredths as compared with kainite are as follows :

	Barley	Rape	Beet	Flax	Clover
Kainite . . . . .	111	33	55	44	25
Leucite	44	24	48	25	86

G A B.

548 - Experiments on the probable Effect produced by the Addition of Sulphur to the Soil. — AVANZI, I (Agrarian Institute of the Royal University of Pisa), in *L'Agricoltura Italiana*, year XLV, Numbers 13, pp 81-88 Pisa, 1922.

The numerous enquiries undertaken and the various hypotheses advanced in recent year as to the effect produced by the addition of sulphur to the soil has led the author to carry out a preliminary test by placing in open ground 20 boxes containing earth mixed with 13.56 % of organic matter and 13.76 % of carbonate of lime, treated respectively in duplicate controls, phosphorite, tetraphosphate, basic slag, mineral phosphate, sulphur, mineral phosphate and sulphur, tetraphosphate and sulphur, basic slag and sulphur, and superphosphate and sulphur, in the boxes were sown selected pure line autumn wheat, 16 plants in each box; the seed had been scalded, and after the wheat a sowing of buckwheat was made. The indices of the different tests were, for the seed wheat 100 — 102 — 91 — 102 — 106 — 99 — 99 — 105 — 109 and 102, and for the buckwheat 100 — 103 — 155 — 100.5 — 113.8 — 106 — 113.3 — 113.5 — 96.3 — and 103.

The result therefore would seem to have proved firstly, that phosphorite and tetraphosphate were less effective in wheat culture than basic slag and, more especially, mineral phosphate. As regards the crop of buckwheat produced, their effectiveness and especially that of phosphorite, seem to have been, on the contrary, rather greater, but still inferior to that of mineral phosphate.

The addition of sulphur to the soil apparently had a good effect on the production of wheat-ears whereas it produced varying results with regard to the straw and yield of buckwheat. The combined action of sulphur and phosphated fertilisers appear to have been favourable, taken on the whole, but considered separately, the results were in several cases contradictory.

These experiments, while suggesting further tests on different lines, lead the author to agree with other investigators who consider that any decisive opinion as to the practical advantage of treating soil with sulphur is at present premature.

G A. B.

549 - **Distribution of Manganese in the Organism of the Higher Plants (1).** — BERTRAND, G. and ROSENBLATT, M., in *Annales de l'Institut Pasteur*, Vol. XXXVI, No 3, pp. 230-232 Paris, March 1922.

In order the better to estimate the physiological importance of manganese, the authors have treated with the metal the largest possible number of the organs of a single species of plant gathered at a certain time, a dicotyledon, the tobacco of the peasants, and a monocotyledon, the Japanese lily.

The effects produced on widely differing organs first confirm the general opinion that manganese should be considered as of quite general occurrence in the organs of plants. Secondly, they show an interesting localisation of the manganese: the greatest quantities of the metal are found in those organs in which the most marked chemical transformations take place. The reproductive organs, in which the exchange phenomena are intense, are placed by the side of the leaves, the young shoots and generally of the chlorophyllian organs. The wood, on the contrary, which plays a rather passive part, is remarkably poor. Finally, the seeds contain a large reserve of metal destined later, no doubt, to supply the early needs of the young plant.

G. A. B.

550 - **Chemical Composition of Diss Ergot and Oat Ergot.** — TANRET, G., in *Comptes rendus de l'Académie des Sciences*, Vol 194, No 12, pp 827-830 Paris, 20th March 1921.

The author has examined the two kinds of ergot reported by Prof. TRABUT of Algiers as distinguishable in diss and oats.

After the closing of the Russian frontier, it was desirable to ascertain whether these ergots could replace that of rye, the only kind used up to the present in therapeutics.

I — Diss (*Lank Ampelodesmos tenax*) is a tall wild gramineae, which grows plentifully in North Africa, especially in the eastern part of Algeria. Its ergot resembles that of rye in form, but is longer, finer and more curved.

The author has analysed about 10 kg. of ergot, gathered in the province of Constantine in June, 1921.

The ergot is ground, treated with alcohol at a temperature of 85° and distilled. The residue obtained by distillation is composed of 2 parts; a red, watery fluid and a mixture of fats and resins. These are separated by ether, the reddish, pulverulent resin is insoluble. By a special process (which is not described), the author has extracted 10 gm. of *ergotinine* from 1 kg. of diss. This is composed of a mixture of approximately equal parts of crystallised *ergotinine* and amorphous *ergotinine* (*hydroergotinine* or *ergotoxine*).

From the fats 120 gm. per kg. of *ergostearine* has been extracted, that is to say from 4 to 6 times more than from rye ergot.

The aqueous fluid, tinged with red colouring matter, *sclerervthrine*, similar to that of rye ergot, after being treated with subacetate of lead and separated by alcohol at 90° boiling, gave on cooling, 8.80 gm. of

(1) See R. Nov. 1921, No 1097. (1d)

mannite and 0.70 gm of trehala 2.80 gm of glucose were afterwards extracted

0.40 gm of *ergothioneine* per kg of the alcohol extract deprived of its sugars were afterwards obtained

II — Oat ergot, short and thick is mostly found in the province of Oran, its size varies according to the year, but it is generally rather small (about 150 gm to the quintal), it does not necessitate sifting, and has not attracted the attention of dealers and veterinary surgeons

1 kg of ergot has furnished 60 gm of fats and 18 gm of resins, which have given 1.80 gm of raw ergotinine from which 0.80 gm of pure white crystallised ergotinine which is a high percentage. The quantity of ergostearine was 0.75 gm. Its aqueous fluids also contain sclererythrine, they yielded 32 gm per kg of a sugary mixture composed of 70 % of trehala and 30 % of mannite (this was from ergot eight months old) 14.2 gm of glucose per kg were measured

0.50 gm of *ergothioneine* were extracted

It will be seen therefore that the same elements are found in the 2 ergots examined as in rye ergot. Diss ergot is poor in crystallised ergotinine, whereas oat ergot is richer than the average ordinary rye ergot. It seems possible to substitute oat ergot for rye ergot in all its uses but diss ergot apparently cannot replace that of rye, except in periods of famine or crisis. Algeria could realise considerable profits from the crops of these ergots.

P. C.

551 — **Methods of Colloidal Chemistry in Plant Physiology. Sensitiveness of Lupins to Alkaline Earth Metals.** — BOAS, F. and MIRKENSCHLAGER, F., in *Centralblatt für Bacteriologie*, II. Abt. Vol. 55 Nos. 1-4, pp. 513-514, figs 3, Jena, 28th Feb 1922

A great number of researches on the biochemistry of lupins have been undertaken especially as to the causes of their morbid condition in calcareous soil. MIRKENSCHLAGER, recently discovered a relationship between the presence of protein in large quantities in the cotyledons of lupins and the injurious action of the lime, but he did not establish the connection of the two factors. He is now trying to do so in collaboration with BOAS, by the aid of colloidal chemistry.

As is known, every modification of the colloidal state of living proteins is of the greatest importance in the development of cellular activity. Great changes can be caused in this respect by acids, alkalis and salts. With regard to the action of neutral salts, it should be remembered that the alkaline salts (sodium and potassium) are only active in a highly concentrated state, whereas the salts of alkaline earths (lime and magnesia) even when slightly concentrated, precipitate the proteins. Therefore if the lupins contained proteins precipitated with comparative ease by these salts (owing to the state of these proteins or because they lack proteic or hydrocarbonated protective substances), this would easily explain the curious behaviour of these plants in limy soil. Now the seeds of lupins are very rich in proteins and very poor in carbohydrates.

in comparing *Lupinus luteus* and *Pisum sativum*, the authors found 45.07 % and 23.10 % of proteins, and 10.02 % and 53.02 % carbohydrates respectively. From analyses made by other authors there are still greater differences in the case of easily removable carbohydrates.

The authors have observed the action of the neutral salts on the proteins of lupins obtained by extraction. Their enquiries deal with 1) "flocculence" (precipitation); 2) viscosity.

**FLOCCULENCE.** — The proteins of the seeds are insoluble in water, but they dissolve during germination: it is possible therefore to prepare sufficiently concentrated solutions by using sprouting grain or young plants, without recourse to sodium chloride or other salts capable of modifying the original physical or chemical state of the proteins. To obtain the extracts, the authors crushed a certain number of the young plants, from 10 to 12 days old and passed the liquid through a piece of linen. They also used extracts obtained through greatly diluted caustic potash, so as largely to neutralise the slight acidity of the lupins caused by the presence of citric acid. The cloudy extract prepared by either method was poured into a number of test tubes similar to those used in serology for precipitation experiments, in quantities of 5 cc. per test-tube. The chloride of potassium added to the extract produced no effect; but if calcium chloride or magnesium chloride be added, a flocculence is immediately noticed; this is produced equally in the pure extract as in the alkaline, but it should be observed that in the second case, the citrate is also precipitated, and this fact should be borne in mind. In the test tubes in which flocculence takes place, the chlorophyll soon forms a sediment, because the internal viscosity of the fluid diminishes. This formation of sediment is more rapid with calcium chloride than with magnesium chloride. After 12 hours the chlorophyll also forms a sediment in the test tube to which potassium chloride has been added; but no trace of flocculence is apparent in the liquid which rises to the surface and which remains clouded; in the test tubes containing calcium or magnesium chloride, on the contrary, the flocculence was followed by a complete sedimentation not only of the chlorophyll, but also of the other proteins, which form with the chlorophyll a thick deposit at the bottom of the test tube, whereas the liquid at the surface is perfectly clear. The smallest quantities of  $\text{Ca Cl}_2$  suffice to produce these effects; a solution as low as 5 ‰ normal is very active.

**VISCOSITY.** — The flocculence of the colloids dissolved in the liquid cause a diminution of the viscosity. The following process was used in experiments on viscosity. The viscosimeter had a moderately fine capillary tube. The extracts were prepared from *Lupinus luteus* and *Pisum sativum* seed, left to swell for one day, then crushed and passed through a cloth: 10 gm. of water were used per 15 gm. of seed.

The lupin seeds are free from starch, whereas the pea seeds contain considerable quantities; but the starch quickly forms a deposit and, consequently does not affect the result. The extract of lupin obtained by distilled water and not treated with salts took 136 seconds to pass through the viscosimeter, and the pea extract, 228 seconds (the distilled water 53

seconds). The great difference between the two plants is due to the fact that the principal protein of lupin, the "conglutine", dissolves with difficulty in distilled water, whereas the pea proteins (principally legumine and viciline) dissolve in distilled water and produce a much more viscous fluid. If a 5 % solution of sodium chloride be used, the result is quite the reverse: they took 364 seconds and 228 seconds respectively. To observe the action of the salts, the authors preferred to use extracts prepared with a much less concentrated solution of sodium chloride (2 %), and after these were prepared they were subsequently diluted to half strength. To every 5 cc of liquid they added 1 cc of a 5 % normal solution of one of the three salts: sodium chloride, calcium chloride or magnesium chloride. After half-an-hour, examination showed that a rather greater diminution was produced by calcium chloride and magnesium chloride in the lupin extracts than that produced by sodium chloride; after 3 hours and a half, the difference became very marked; in the pea extract, on the contrary, the three salts acted in the same way and did not reduce the viscosity to any appreciable extent. These results prove that the alkaline-earth metals considerably modify the lupin proteins, whereas they remain practically inactive in the case of the pea proteins.

In conclusion, the salts of the alkaline-earth metals (calcium and magnesium) even in slight quantities (traces), cause the abundant proteins of the seeds and young plants of the lupin to become flocculent. As the vital activities of the living organisms are associated with a definite structure of their proteins, the "sensitiveness" of lupins to lime is explained: they become really intoxicated with this element. The flocculence of the proteins renders certain constituent parts of the living cells inert, and affects their functions: the movement of iron, for instance, is probably impeded. The results obtained *in vitro* then can be applied without difficulty to the living organism. It must be observed that whereas the injurious action of lime on lupins is well known, that of magnesia has never aroused the attention of cultivators, probably because magnesia is almost always found with lime (in marl, dolomites, etc.) and the natural tendency is to attribute the injurious effect noticed to lime only, whereas the magnesia is equally deleterious. However, a number of authors have already recognised that magnesia is also injurious to lupins: for instance, R. HEINRICH has noticed that magnesium carbonate when added to the soil, even in the proportion of 0.5 %, completely hinders the development; PFEIFFER and SIMMERMACHER have noted the injurious action of carbonate and sulphate of magnesium, etc., and thus research *in vitro* and cultural research are entirely in accord.

A noteworthy fact is that while the action of calcium and magnesium is almost the same during the first stages of development in the plant, it is different in the later stages: this proves that in studying the mineral needs of plants, they should not only be considered when fully grown, but also in the initial stages. The injurious action of calcium and magnesium is probably aided by the insufficiency of carbohydrates in the lupin seeds, for these protect the proteins, as has been proved by



A. MEYER. Calcium and magnesium act independently without the active assistance of the anion with which they are associated; this may be deduced from numerous experiments reported in agricultural literature. The complexity of the relations between the different salts contained in the soil explains certain divergences and apparent contradictions which have been remarked. The theory that calcium liberates hydroxylions must also be excluded.

L. V.

552 - Influence of Mechanical Pressure on the Growth and Structure of Wood. —

KURZ, J., in *Centralblatt für Bacteriologie*, Part II, vol. 55, Nos. 11-13, pp. 293-297, 3 figs. Jena, 5th, Jan. 1922.

Numerous experiments have been made on this question. They have been directed on the one hand to the influence of the pressure as affecting the normal growth of wood, and on the other to the irregularities in the wood caused by strong external pressure. The second part of the problem, can be treated experimentally and also by making use of samples of wood growing under natural conditions, as, for instance, when two stems or branches have pushed one against the other, crushing and joining, or when a tenacious climbing plant or creeper has twined round a young stem. The structure of the wood thus produced has been described by KÜSTER, who also quotes the literature bearing on this subject. On the advice of KÜSTER himself, the author has examined a fine sample of *Ficus mysorensis* round which a *Ficus parasitica* had twined.

He first describes the normal state of the wood of *F. mysorensis*, as in the parts not subjected to pressure; this wood is formed of regularly alternating layers of parenchyma and sclerenchyma, the second rather the thicker, the vessels are comparatively rare, enclosed between the sclerenchyma fibres and bounded on one or more sides by the parenchymatous tissue. The frequency of the layers varies where they are wider, their direction is more regular, where they are thicker, they generally show irregularities and, instead of forming complete rings, they split into fragments and reunite, they shoot off from either side of the medullary rays. Similar irregularities are found in our wood, amongst for instance elms. They prove that the layers have no connection with the rings showing annual growth. If the section is well polished, deep, annular, concentric streaks of irregular form are seen, the microscope reveals no special structure, but only a brown coloration of the cellular walls. The medullary rays have from 1 to 6 layers of cells, the average being from 2 to 3.

The author next examines the part which has been subjected to pressure. He first enquires whether the growth of the wood continues under very strong pressure, or whether the activity of the cambium is suppressed; and favours the former hypothesis, basing his opinion on the researches made by SCHWENDENER, HOFFMANN and KÜSTER. On either side of the strong climber which exerted the pressure, the wood under examination formed, as it were, two long wedges, clearly differentiated from the wood of normal growth, both in appearance and structure, in the section

they appear to be separated from the normal wood by a line of demarcation visible even to the naked eye. In passing from the normal wood between the lateral zones, the woody layers change their direction: from tangential they tend to become radiant, and are then interrupted; the change of direction is abrupt, angular and takes place along the line of demarcation. The medullary rays reciprocally bend tangentially in a slight curve which does not affect all the rays near the edge of the two zones; towards the interior, on the other hand, where the zones become slender and the pressure has been stronger, the fold becomes more accentuated and assumes an angular form. The woody bundles and medullary rays, instead of meeting at right angles as in the normal wood, forming small squares or rectangles, meet obliquely and form lozenge shaped spaces. A change of structure is also to be noticed towards the line of demarcation, the fibrous fascicules of the normal wood become stouter, and their walls are very strong; these characteristics are also met with towards the interior of the normal wood, which does not undergo any special pressure. The wood subjected to pressure, which forms the two cuneiform zones is, on the other hand, of weak structure; the cells have mostly thin walls, near the line of demarcation, the sclerenchymatous parts are reduced to islets in the parenchyma; only at a certain distance from the line of demarcation does the normal structure reappear. The woody bundles and medullary rays remain continuous in passing from the normal to the compressed wood, but it is evident that the growth of the compressed wood has not continued in the direction of the cambium, but has branched off. In the particular case, the abrupt change of direction is due perhaps to sudden pressure.

L. V.

553 - **The Multiplicity of the Species of Radicular Bacteria in Plants observed by means of Serological Processes.** - KLIMMER, M. in *Centralblatt für Bakteriologie*, II Abt., v 35, Nos. 11-13, pp. 281-283. Jena, 5th Jan 1922.

The author defines and confirms the opinion that there are numerous species of radicular bacteria in plants. He has used what are called the serological processes, as extensively used in human and veterinary bacteriology to differentiate and classify pathogenic bacteria (1).

(1) In the serological processes the bacteria under examination, in pure cultures, are injected into the bodies of animals used for experimental purposes. The animals thus treated react against the microscopic invaders by producing substances called "anti-bodies", these animals are afterwards treated and the serum containing anticorps is taken from the blood; by means of these anti-bodies the serum can cause characteristic modifications in bacterial cultures if identical with those injected; on the other hand it has no action on other species. It also modifies in varying degrees analogous bacteria cultures (group reactions). The modifications caused by the serums in bacteria cultures are many and various; sometimes the bacteria are killed outright; often the mobile species are paralysed and obliged to adhere to one another; the cultures may also be precipitated in the liquid; in most cases the bacteria also undergo a change which is shown by the fact that the dissolved blood prepared *ad hoc* becomes

The author, has employed agglutination, precipitation and fixation of the complement, applying a process already described by him. He considers the agglutination as negative when it takes place below the limit of 1 : 20, or if it also takes place among the controls that is to say without any addition of serum (auto-agglutination) or with serum from an animal not treated or normal serum. Precipitation is preferable on account of its simplicity, it is not usually necessary to dilute the serums unless the controlling tests also show positive results. The author uses the zonal or layer reaction, in which small tubes may be used and the consumption of serum lessened, the cultures for antigenous reaction are prepared in agar immersed in salt water killed by heat and the bacteria separated by filtering or they are centrifuged.

As a result of experiments undertaken in collaboration with KRIEGLER on 18 species of plants the author has been able to distinguish 9 species of nitrophagous bacteria namely

1<sup>st</sup> species found in *Lupinus perennis* L. *luteus* and *L. angustifolius* and *Ornithopus sativus*

2<sup>nd</sup> species found in *Melilotus albus* *Medicago lupulina* *M. sativa* and *Trigonella Foenum-graecum* it corresponds to the classic *Bacillus radicicola*

3<sup>rd</sup> species represented by the radicular bacteria of *Lotus uliginosus* *Anthyllis vulneraria* and *Tetragonolobus purpurea*

4<sup>th</sup> species includes the radicular bacteria of *Pisum arvense* and *Vicia Faba*

5<sup>th</sup> species confined exclusively to the *Vicia Faba* bacteria

Species 6 to 9 found in the nodules of *Trifolium pratense* *Phaseolus vulgaris* *Soja hispida* and *Onobrychis sativa*

By noting the strength of the serums used the author has been able to observe the relationships or analogies between some of the species mentioned. Results show for instance that whereas the specific serum prepared with the *Trigonella Foenum-graecum* bacteria agglutinates the same bacteria in the proportion of 1 : 10 000 it agglutinates the *Tetragonolobus purpurea* bacteria at 1 : 100 only a degree in which even the normal serum is active though only slightly. Any affinity between these two groups of bacteria must therefore be excluded. On the other hand there are rela-

tioned. These actions, called bactericidal, agglutination, precipitation, fixation of the complement, etc., are attributed each to a special antibody (bactericidal, agglutinative, precipitative, amoebocytic, etc.) which vary according to the bacteria injected. Some of the action take place even if the serum is greatly diluted, thus agglutination may be caused where the proportion is 1 : 10 000 and even beyond if cultures identical with those at the beginning are used (homologous cultures) in the case of analogous cultures the same serum agglutinates in lesser dilutions, and in that of different cultures it acts only at a very low ratio of dilution for instance, 1 : 10, as is also the case with the serum of animals not treated here the reaction is considered as negative. The serological processes which have been extensively used for twenty years in medical bacteriology to diagnose species and sub-species of bacteria have on the other hand, been very little used in agricultural bacteriology (Ed)

tionships or group reactions among the *Anthyllis*, *Lotus* and *Tetragonolobus* bacteria ; tested by the agglutinating reaction, they are confirmed by the fixation of the complement. The specific multiplicity of the *Phaseolus*, *Vicia Faba* and *Vicia sativa* and the close relationship, if not identity of the *Vicia sativa* and *Pisum* bacteria, already previously noted, have been confirmed by VOGEL and ZIPPEL by means of agglutination and precipitation experiments.

L. V.

**554 - Improvement of the "Civitella" Variety of Wheat by Individual Selection in Tuscany.** — AVANZI, F., in *L'Agricoltura Italiana*, Year IV, Parts, 1-5, Pisa, 1921.

In certain parts of Tuscany, the name "Civitella" is given to a variety of rivet wheat which, though it has lost favour in some areas, is increasingly cultivated in others even to the extent of supplying the increasing demands for wheat from other districts.

As this variety has excellent qualities and is widely cultivated, the author decided to improve it by means of individual selection. This work was begun in 1917-1918 in the field of the Agricultural College at Pisa, and continued and extended in the following years. From the beginning of the experiments, the existence of two chief sub-varieties was distinctly seen.

A) consisting of the offspring of a more or less dense ear, bearing 3 to 5 fertile flowers,

B) consisting of the offspring of a rather compressed lax ear, with spikelets bearing as a rule 2 to 3 fertile flowers.

The greater number of individuals composing the Civitella variety usually grown may be included in the sub-variety A. The cultural experiments made during the last three years have also clearly demonstrated the greater productivity of this sub-variety, though its grains, while large and fine, are inferior to those of the sub-variety B.

By means of selection, starting from individuals belonging to each of the sub-varieties, four families were founded : 38-45-49-65

The Table gives the yield in 1920-1921 at Piaggia and San Cataldo (Pisa).

As it had been found that the above-mentioned families were more productive than the ordinary varieties, they were tested in parts of Tuscany showing marked differences both in climate and soil.

The results of these trials will make it possible to control the data obtained in previous years from growing family 38 and the other three families which, although very similar to one another, differ considerably as regards resistance to lodging and scald, as well as in their powers of adaptation to soils of various characters.

In the meanwhile the work has not been interrupted but extended to a number of new families that will have to be gradually compared with those previously isolated and bred, in order to determine by means of cultural experiment and chemical research, the lines which are most worthy of further propagation.

*Analytic data respecting the 4 families of "Civitella"  
obtained by individual selection.*

	Grain			Straw	
	Litres	Kg.	Weight of 1 hectolitre in kg.	Kg.	Correlation between the weights of the straw and of the grain
<i>Pisgisa:</i>					
Civitella 38. . . . .	3 822	2 818	73.7	8 286	2.94
Civitella 47. . . . .	3 302	2 449	74.1	7 275	3.33
Civitella 49. . . . .	3 790	2 565	67.9	8 186	3.57
Civitella 65. . . . .	3 785	2 736	73.3	9 037	3.30
<i>S. Cataldo:</i>					
Civitella 38. . . . .	2 153	1 606	73.6	4 200	2.62
Civitella 47. . . . .	2 761	2 003	72.5	6 373	3.18
Civitella 49. . . . .	3 351	2 516	75.1	5 591	2.22
Civitella 65. . . . .	2 951	2 260	76.6	6 100	2.70

G. A.

555 - "Rubin", an Early Spring Wheat for Central Sweden obtained by Crossing the Native Dala Variety with Kolben of Svalöf. — ÅKERMAN, Å., in *Sveriges Utsädesförmågs Tidskrift*, Year XXXII, Part 1, pp. 48-59. Malmö, 1922.

In the southern part of Dalarna, and in some districts of Central Sweden, the original Dala wheat, an awned native variety with dark ears (Dalårvarvete = Daba spring wheat), or other local wheats of a similar type, are still grown. These varieties are noted for their very early ripening and the excellent quality of their grain. On the other hand, they produce small, rather loose ears, with weak straw, and are especially susceptible to the attack of rust. Their yield is very light, being 20 to 30 % below that of Extra-Kolben.

For this reason, efforts have been made to introduce more productive types, such as Kolben, Extra-Kolben and others, although they have the defect of being late varieties, and in cold wet seasons never ripen properly, so that the grain is of inferior quality. In 1900, experiments were begun in Svalöf with the object of producing spring wheats suitable to the special physiological conditions of Central Sweden. The individual selection of Dala native wheat and early Norwegian Börsum wheat did not give satisfactory results and it was therefore considered advisable to carry out experiments in crossing.

In 1906, NILSSON-EHLE crossed Dala spring wheat with Svalöf Kolben wheat, and obtained by selection the line 0880, which was considered the best and at once put on the market, after the necessary cultural tests, under the name of Rubin spring wheat (Rubinårvete).

The object of crossing was to unite in a single type the earliness of Dala with the high yield of Kolben, and at the same time to obtain a high degree of resistance to rust to which the other native wheats and also the Norwegian *Borsum* variety are generally very susceptible. An attempt was also made to combine early maturity with stiff straw, and also, if possible, to eliminate the awns in order to lessen the mechanical action of the wind.

From the comparative cultural experiments made at Svalöf and the Sub-Stations of Ötgöta, Västgöta, and Ultuna, the following conclusions may be drawn.

**EARLY RIPENING** — As regards the length of the vegetative period, "Rubin" is hardly 2 to 3 days inferior to Dala and out-strips Kolben by at least 4 to 5 days. The number of days to heading was actually as follows:

*Svalöf*. 0880 Rubin 115 0, Dala 114 0, 0702 Svalöf-Kolben 118 3; 0841 Extra-Kolben 120 0

*Ultuna*. 0880 Rubin 113 5, 0841 Extra-Kolben 124 0; 0702 Kolben 123.6; native Dala spring wheat 111 5

*Tornby*. 0880 Rubin 114 4; 0821 Extra-Kolben 118 9, 0702 Kolben 117 3; native Dala spring wheat 111 4

*Skara*. 0880 Rubin 115 0; 0841 Extra-Kolben 121 7, 0702 Kolben 120 0; native Dala spring wheat 112 3

**GRAIN AND STRAW YIELD** — The author gives the data for the two Sub-Stations of Skara (Västgöta), and Ultuna. At Skara, produced in 1917-1921 an average of 2152 kg. per hectare, if this is taken as 100, Rubin produced 101, Dala 98, and Extra-Kolben 110. At Ultuna, Kolben produced in the period 1916-1921 (with the exception of 1918), an average of 2173 kg. per hectare. If, as in the preceding case, this is taken as 100, Rubin produced 82, Dala 61, and Extra-Kolben 103.

Rubin is thus clearly superior to Dala in grain production and also though to a less degree in straw-yield.

**RUST RESISTANCE** — Rubin is more susceptible to rust than Kolben, but is much more resistant than Dala. An empiric scale where 10 = free from rust and 1 = severely attacked gives results as follows: (*Svalöf* 1916), 0880 Rubin 5; Dala 1; 0702 Kolben 8; 0841 Extra-Kolben 9.

**STRENGTH OF STRAW** — If a scale of resistance ranging from 0-10 (0 = non-resistance, 10 very resistant) is taken, the figures are:

*Svalöf* — 0880 Rubin 8; Dala 5; 0702 Kolben 8; 0841 Extra-Kolben 4.

*Skara*: 0880 Rubin 9.4; Dala 5.3; 0702 Kolben 8.8; 0841 Extra-Kolben 9.3.

Resistance is about the same as that of the parent Kolben, but exceeds it in some cases.

**EARS** light-brown and awnless.

**WEIGHT OF HECTOLITRE AND WEIGHT OF 1000 GRAINS.** — Equal or a little lower than in the case of Kolben. At Ultuna, the averages for 1916-1921 were

**WEIGHT OF HECTOLITRE** (in kg.): 0880 Rubin 74.4; 0702 Kolben 73.9; 0841 Extra Kolben 72.4; Dala 73.4

**WEIGHT OF 1000 GRAINS** (in gm.): 0880 Rubin 33.4; 0702 Kolben 33.9; 0841 Extra-Kolben 34.5; Dala 30.3.

The object of the cross viz., "to obtain an earlier ripening Kolben", was thus attained to a very satisfactory extent. The new spring wheat is especially adapted to the conditions in Central Sweden, where it can with advantage be substituted for the native types. It may also be recommended for the high regions of the interior of South Sweden where Extra-Kolben is found to be too late in ripening. G. A

556 - **Orion of Svalöf an Early Black Variety of Oat for the Norrland obtained by the Cross Ligowo × 0668.** — ÅKERMAN, Å., in *Svenska Utsädesföreningens Tidskrift*, year XXXII, Part 1, pp. 4-16, figs. 2. Malmö, 1922.

In the northern and mountainous sectors of Norrland, the frostless season is very short and it is therefore necessary to grow the very earliest varieties of oats, in order that they may ripen some time before the first frosts and cold weather of autumn begin.

The vegetative season of the native oats is undoubtedly short, but their yield is very low, the quality of the grain is poor and the straw weak. For these reasons, 6-rowed barley has always been the favourite cereal in these latitudes, and scarcely any oats have been cultivated. For a long time the "Svenska Utsädesförening" has considered it advisable to carry out selection work with a view to obtaining a type of oat as early in ripening as the native varieties but at the same time producing a heavy yield, stiff straw and grain of good quality.

Since the end of 1890, the results of the individual selection of local native populations had been far from satisfactory; therefore in 1903, a first series of crosses were made between Ligowo (an oat well known for its high productivity and the excellent quality of its grain), and line 0600 of Nordfinsk Svartthavre (Black North Finnish Oats), and line 0668 of a native variety from Nordland (Norway).

From the first cross was obtained the line 01120 Björn of Svalöf oat, and from the second, the Orion of Svalöf oat, line 1101.

The Cross Ligowo × 0668 was effected in 1903 and the first cultural experiments made in 1910 at Svalöf. The line proved to be still far from homogeneous and it was therefore thought well to make a further selection in 1911 by isolating the line *b* which is the most cultivated at the present time.

Since 1914, the most important lines of Orion (01101 *b*; 01103; 01102 etc.), have been subjected to comparative cultural experiments on a large scale in various provinces of Sweden; they have been chiefly compared with Mesdag, a very early variety of oat, which is the favourite in the Northern districts. The data obtained from these experiments are as follows:

1) **EARLY RIPENING.** — Orion ripens on an average only two days later than the earliest types of oats grown in Norrland, but it is distinctly

superior to Guldregn. The following data were obtained from Holm (Ängernanland), as to the number of days from the vegetative period till maturity during the period 1917-1920: 01120 C. Björn II 90.; 01101 b, Orion 88; 01102, 99; 10 d. Orion, 89; 01104 328; 14 d Orion 88; Mesdag, 86; 0386 Guldregn, 95.

2) YIELD. — In Norrbotten and Vasterbotten, Orion produced 5.5 % more grain and 7.5 % more straw than Mesdag. The difference in favour of Orion increases and reaches 15.8 % (grain) if Orion line b is the type in question. The same returns were made from Jämtland. If the grain yield of Mesdag is estimated at 100.0 those of 01101 b Orion and of 01163 b Odál were respectively 129.6 and 126.6. On the other hand, at Holm and in the districts of Västermorrländ, where the climate is better, Odál takes the first place.

OTHER CHARACTERS. — Long, but comparatively stiff straw: grain of good quality; the weight of 1000 grains is greater than in the cases of Mesdag, Björn, and Nordfinsk Black Oats; the weight per hectolitre is equally satisfactory. In Orion, the glumes of the seed are very thick, so that the enclosed grain is relatively small. It must, however, be observed that in a very rigorous climate, strong glumes serve to protect the embryo against the action of frost and insure a higher capacity of germination.

Briefly it may be stated that the objects in view in making the cross Ligowo × 0668 have been obtained in a very satisfactory manner on the whole, since the hybrid produces a heavy crop of grain of good quality ripens early and has stiff straw.

Orion will certainly take the first place in the Provinces of Norrbotten, Västerbotten and Jämtland G. A.

557 — An Enumeration of the Dominant Characters of Barley. — FRASER, C., in *Scientific Agriculture*, Vol II, No 4, pp 113-116. Gardenvale, P. Q. December, 1921

The author unites in this article all the data respecting the determination of the dominant characters of barley.

The list is as follows.

- |                           |                                  |
|---------------------------|----------------------------------|
| 1) Black colour of palea  | dominant as regards white colour |
| 2) Two rows               | SIX ROWS                         |
| 3) Hood                   | awn                              |
| 4) Purple colour of palea | white colour                     |
| 5) Coloured grain         | colourless grain                 |
| 6) Narrow glumes          | broad glumes                     |
| 7) Loose ears             | close ears                       |
| 8) Adherent palea         | non adherent palea               |
| 9) Brittle rachis         | resistant rachis                 |
| 10) Awneel ears           | hooked ears                      |
| 11) Rough awns            | smooth awns                      |

1) BLACK COLOUR OF THE PALEA. — The dominance of black as regards white was already known before the revival of Mendelism and instances of this dominance were reported by RIMPAU. TSCHERMAK fixed the ratio in



the  $F_2$  as 3 : 1, and BIFFEN obtained the same results in the following crosses between white and black varieties :

*H. japonicum* × *Steudelii*  
*H. vulgare* × *Steudelii*  
*H. mutans* × *Steudelii*

He invariably obtained in the  $F_1$  black individuals and in the  $F_2$ , black and white individuals in the ratio as 3 : 1.

Although the recessive type was cultivated for a long time, it never produced any black forms.

2) NUMBER OF ROWS — In this case the dominance is not as absolute and indisputable as in the former. In the results of a series of crosses made at Ottawa (Canada), SAUNDERS observed cases of incomplete dominance. He discovered in some of the  $F_2$ , in addition to the extreme forms, a series of intermediate forms ranging from 2 to 6 complete rows. In the  $F_3$ , however, nearly all the six-rowed individuals behaved as true heterozygotes (typical intermediate forms) and produced a mixed progeny of which 25 % were two-rowed, 50 similar to their parents and 25 % six-rowed.

3) HOODED — The dominance of this character over the awned condition is proved by the following crosses

*H. trifurcatum* × *H. mutans*  
*H. vulgare* × *H. atrum*  
 Black Hulled × Beardless

In the  $F_1$ , there are always trifurcate individuals with supernumerary sessile flowers. In the  $F_2$  there are trifurcate forms and awned forms in the ratio of 3 : 1.

4) PURPLE COLOUR OF PALEA. — Dominant as regards white.

5) PIGMENTED, OR UNPIGMENTED GRAIN. — The presence of pigment in the palea seems to be correlated with the colour of the grain, whereas in wheat, as is well-known, the colour of the palea is quite independent of the grain. The character of "coloured grains" is dominant as regards that of "colourless grains."

6) NARROW GLUMES AND BROAD GLUMES. — In the greater number of barleys, the glumes are narrow, there are, however, some varieties in which they are oval-lanceolate. By crossing *H. abyssinicum* with *H. Steudelii*, or *H. abyssinicum* with *H. trifurcatum*, narrow glumed individuals are obtained in the  $F_1$ , whereas in the  $F_2$ , and the  $F_3$ , there are narrow glumed hybrids and broad glumed hybrids in the ratio of 3 : 1.

7) LOOSE AND CLOSE EARS — As SPILMAN has been able to prove in the case of wheat, the heterozygotes of the  $F_2$  are in intermediate conditions. Cases have occurred where the  $F_1$  had still looser ears than their loose eared parents. The same is reported of the  $F_2$ . According to BIFFEN this is probably due to a rather larger number of genetic factors.

8) ADHERENT PALEA. — Dominant as regards non-adherent.

9) STRENGTH OF RACHIS. — Many varieties of barley have a more or less brittle rachis. This brittleness attains its maximum in *H. spontaneum*,

the ripe ear falling apart of its own accord. On crossing *H. spontaneum* with six-rowed varieties with hooks and rather resistant rachis, individuals with brittle rachis are obtained in the  $F_2$ . Although very complex segregation has taken place in the  $F_2$ , brittle individuals and resistant individuals occur in the ratio of 3 : 1.

10) AWNLESS AND HOOKED FORMS — There are very few data regarding these. From *H. nigrosubinerme* (awnless)  $\times$  *H. hexastichofurcatum* (hooked), were obtained in the  $F_1$ , some individuals resembling the awnless parent, and in the  $F_2$ , out of the 41 individuals, 27 were awnless, 7 hooked and 7 awned. These 41 individuals were the progeny of a single plant of the  $F_1$ .

11) STRUCTURE OF AWNS — Many varieties of barley have a characteristic denticulation of the awns rendering them rough to the touch. The rough form is dominant as regards the smooth. G. A.

558 - Behaviour of the Character "Ramified Female Inflorescence" in the Cross with Maize Plants having normal Ears.—KIMPTON, J. H., in *United States Department of Agriculture, Bulletin No. 971*, pp. 1-20, figs. 5, Plates I-XVI. Washington, December 1921.

The variation of maize known under the name of "ramified" (*Zea ramosa*), is characterised by having branched female inflorescences, while the male inflorescences, which in normal types are little ramified at the base and possess a very well differentiated central axis, are much branched, the ramifications extending to near the top of the median axis.

For the crossing experiments, the Gordo variety of maize (from Chihuahua, Mexico), was chosen, this is characterised by the reduced ramification of its male inflorescence, which has two or three branches at the base and a very distinct central spike of which the length may be as much as 50 centimetres.

In the  $F_1$ , the character "branched" behaves as a recessive, and the ears of the hybrid are normal, having no ramifications. In the  $F_2$ , segregation takes place into normal individuals and ramified individuals in the usual ratio 3 : 1. Biometric determinations have, however, shown that the ramified plants that segregated in the  $F_2$  no longer possessed the typical form, for they had acquired some of the characters of the Gordo parent, the same occurred in the normal individuals that segregate in the  $F_1$ .

In the "ramified" group, the structure of the terminal panicle and of the female inflorescence showed great variability. Some of the plants classed as "ramified" from the characters of the male inflorescence, yet possessed unbranched ears. Among them a complete series could be found ranging from the typical ear to the ramified inflorescence.

Generally the intermediate female forms were accompanied by a male inflorescence of a similar intermediate form. In the  $F_3$  the progeny had ears ranging through all the intermediate forms up to the extreme types, whereas the male inflorescences were intermediate in character. In the  $F_4$ , the results obtained confirmed what had been observed in the preceding generations. Two of the hybrids certainly had normal ears with no signs

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of ramification, but the influence of *Zea ramosa* was very clear in the male inflorescences. Although the progeny might differ considerably from one another, the results obtained in the  $F_4$  indicate the possibility of isolating constant intermediate forms, and make it more difficult to interpret the phenomena as being due to certain basic factors.

If the results obtained in the first and second generation may be regarded as representing a monohybrid ratio, this explanation certainly does not hold good in the case of the  $F_4$ . In addition to the chief determining factor, there are no doubt other genetic factors giving rise to constant intermediate forms. There is, however, no sufficient evidence to show whether these intermediate forms are due to multiple factors, or to factors which influence the chief factor in such a manner as to modify its expression.

G. A.

**559 - The Improvement of the Oil-Bearing Sunflower by Selection, in Bulgaria.**

KIOUMIOURDJIEFF, I. V., in *Semlédiétje* (Agriculture), year XXV, Part 9, pp 117-119 Sofia, 1921

The commercial varieties of sunflower cultivated in Bulgaria for oil production are from the genetic point of view a mixed population composed of a large number of forms.

There is, however, to be found in Bulgaria a type of sunflower valuable both for the quantity and quality of its oil, but as it has never been selected, this type has become so contaminated and mixed that its oil yield has greatly suffered. It is therefore necessary to have recourse to careful sorting, and in making choice of seed plants, the established rules of physiological selection should be observed.

1) The fruit must be taken from plants that have not branched during the summer.

2) All very luxuriant plants should be rejected. It is best to select those of average growth.

3) The fruits ought to be of moderate size and their surfaces covered with seeds of the shape and dimensions best suited for the purpose.

One type of sunflower fairly frequently seen in plantations has thickish rounded seeds (like coffee-beans), with a fawn-coloured integument and spherical kernel, and this type should be preferred to any other.

Another form also occurs which bears equally short rounded seeds, with tough integuments, but of a darker colour and having light stripes on either side, this type might produce by selection a variety resistant to the insect (*Homocossoma nebulella*?), a parasite, which causes damage every year.

G. A.

**560 - On the Advisability of Selecting the Native Tobaccos in Bulgaria.--** TOCHIEFF,

I. V., in *Semlédiétje* (Agriculture), year XXV Vol 8, pp 119-121 Sofia, 1921

The varieties of tobacco cultivated in Bulgaria are, from the genetic standpoint, populations composed of numerous distinct forms differing from one another in their morphological characters and physiological constants. The sorting of these populations would improve the quantity

and quality of the tobacco produced. For the first year, female parent plants should be selected, the following characters being taken into account:

- 1) The number, position and size of the leaves;
- 2) The nature of the stem, which should be sufficiently strong, little inclined to the production of suckers, and with leaves growing close together.
- 3) Resistance to diseases and to injurious insects, especially *Thrips*.
- 4) The earliness or duration of the vegetative period. In cold regions, such as for instance the hilly and mountainous parts of the Balkans early maturing types are necessary.

The inflorescences of the mother plants chosen according to the above requirements are isolated at the right time to prevent crosses.

The seeds of each plant are sown the second year in separate plots, the plants in each plot being carefully examined as in the preceding year, and the inflorescences isolated. When the plants have reached their technical maturity, the 4-5 first leaves are carefully removed, those from each plant being kept distinct, while the 4-5 leaves still remaining on the stem are left until the seed ripens.

The leaves thus collected are carefully analysed as regards the following characters:

- 1) Weight of leaves per plant;
- 2) size of leaf-blades,
- 3) thickness and percentage of veins,
- 4) colour and structure of leaves;
- 5) ignition properties.

The same operations are repeated in the following years, until the required characters have become fixed, and the lines thus obtained have acquired the necessary homogeneity.

G A

561 - **Difficulties arising in Experiments on the Improvement of Fruit-Trees by means of Crossing and Selection.** — DORSEY, M. J., in *Scientific Agriculturist* Vol II, No. 4, pp. 118-120 (Gardenvale, P. Q., December 1921).

Sterility (auto-, or stamino-sterility), is one of the chief obstacles encountered in the course of genetic work on fruit-trees. Recent observations have shown that arrested development may occur at any moment during the complicated process of the sexual mechanism. From the genetic standpoint, the effects are equally important whether this arrested development manifests itself either in the gamete, or the zygote, for it can prevent the combination of factors which is for many reasons particularly desired. The study of pollen shows that in a great number of varieties especially in species hybrids, there is a variable quantity of aborted pollen. In certain cases, the abortive pollen is the factor that checks fruit-setting. If these abortive grains represent some determined combinations of character, it is clear that some of the possible gametic combinations are excluded. Similarly, if the development of the embryo is arrested before it reaches maturity, a number of possible new types are eliminated in the same way. Further eliminations may also take place during the interval between fer-

tilisation and the maturity of the seed. Seeds that are incapable of germination are the results of a subsequent loss of gametes, amongst which these may be combinations that are little disposed to further germination.

In order to be able to give a satisfactory interpretation of the phenomena of heredity, it would be well to determine in each case the moment in the biological cycle when the suppression of the essential organs took place. The frequency with which this phenomenon occurs and the resulting consequences could certainly be estimated by workers carrying out crossing experiments on a large scale who would note the approximate quantity of sterile pollen and the number of abortive pistils belonging to the large number of flowers that do not set seed, and of seeds that are incapable of germination.

It is thus extremely difficult to obtain any desired type by a cross based only upon the characters of the two parents, especially if the latter belong to different species, as actually occurs in a large number of cases.

It would be advisable, in the face of these difficulties not to try to obtain immediate results at first, but to make a thorough study of the material afterwards to be used in the work of improvement. In the first place it is necessary to determine the best varieties to use for the crossing experiments; for the best parents are the starting point for the production of new varieties.

Much has already been done in this direction, not only for commercial varieties, but also for the native species.

In the second place, the genetic history of some well known hybrids should be carefully studied with a view to increasing what is already known touching the transmission of fruit characters and to fix the laws of their heredity, which would provide a systematic and scientific basis for work, instead of a merely empirical estimate.

G. A.

562 - **The Possibility of Transmitting by Vegetative Propagation the Character of High Productivity in certain Apple-Trees.** — DAVIS, M. B. in *Scientific Agriculture*, Vol II, No. 4, pp. 120-121, fig. 1. Gardenvale, P. Q., December 1921.

After a reference to previous experiments which would seem to have proved that positive results can be obtained in the case of citrus trees (SHAMEL) by grafting well selected scions on productive stocks, although only negative results were observed for apple-trees (GARDENER with the Ben Davis variety), the author gives an account of the observations made at the Agricultural Experiment Station of Ottawa (Canada) regarding the transmission by vegetative propagation of the character of productivity in the case of apple-trees.

A certain number of trees were chosen for the experiment, and in 1896, the first observations were made and data collected; in 1906, scions were taken from:

- a) the tree which had produced the highest total yield during a period of eight years (571.6 lb.);
- b) the tree which had produced the lowest yield (184.50 lb.);

c) the tree which had produced the most regular crop and a high yield (354.6 lb.).

Although differing in yield, the trees were nearly similar in other respects, such as growth, quality of fruit etc.

The scions were grafted on the Rose of Stanstead and on Dartmouth.

The 17 descendants of the tree that had produced the highest yield bore in 9 years 4374 lb. or 257 lb. per tree.

The 8 descendants of the tree with the lowest yield produced in 9 years 1269 lb., or 158 lb. per tree. Finally, the 12 descendants of the tree that had produced the most regular crop, which was at the same time a heavy one, bore in 9 years 2612 lb., or 219 lb. per tree.

The descendants not only differed in productivity, but also in the vigour of their growth, which was distinctly inferior in the progeny with low yields. There thus seems to be a very close connection between yield and growth. In order to complete and test these experiments, the following test was carried out. Scions taken from the three trees already mentioned were grafted upon 5 large trees, the branches selected for the purpose being as uniform as possible. Three scions, each taken from a different tree, were grafted on each stock, care being taken to vary the position of the graft upon the stock in such a manner as to obtain the most uniform conditions possible. Thus if the scion taken from a tree of low yield was grafted on the north side of the 1st stock, it was grafted on the neighbouring tree on a branch exposed to the south, and so on. The following Table gives the results of the five-year period 1911-1915. They confirm in the main the results obtained in the previous case, except that the offspring of the tree with the most regular crop and a large yield took the first place. The offspring of the tree with low yield was also noticeable for poor crops.

*Data regarding the crop for the Five-Year Period 1911-1915.*

Distinguishing number of trees	Progeny of unproductive tree	Progeny of tree with high yield and most regular crop	Progeny of the most productive tree
36-21	48.37	144.00	103.62
43-13	67.50	70.87	87.75
43-27	13.50	137.25	56.25
42-25	1.12	27.00	22.50
45-7	33.70	54.00	74.25
<i>Totals . . .</i>	<b>164.23</b>	<b>433.12</b>	<b>354.37</b>

G. A.

563 - Means of Obtaining, by suitable Crossing Varieties of Grapes without Pips. — SROUT, A. B., in *New York Agricultural Experiment Station, Geneva, N. Y., Technical Bulletin No. 82*, pp. 1-16, Plates I-VII, Geneva, N. Y., January 1921.

The structure of the vine flower has for a long time been a matter of interest to vine-growers and students of heredity desirous of producing types of grapes with few or no pips. It is desirable and in fact most necessary, for those engaged in the study of genetics to determine as accurately as possible the extent to which crossing operations can influence the distribution of the sexual organs in the flower, and to regulate them.

It is well known that in all varieties, fruit production depends upon the development of the stamens and pistils and upon their capacity to act as sexual organs in the processes of fertilisation and the setting of fruit.

The self-fertilising varieties, such as Delaware, Niagara, Winchell and Concord, bear flowers having equally developed androecium and gynoecium which are capable of functioning *inter se*, even upon the same flowers; these are therefore complete hermaphrodites and are fertilised by self-pollination.

On the other hand varieties such as Brighton, Lindley, Baty and Massasoit, have recurved instead of erect stamens or the stamens are more or less aborted, and have shrivelled and defective pollen-grains. The pistil is however normally developed and in such cases, self-fertilisation is rare, and the intervention of foreign pollen is necessary (imperfect hermaphrodites).

There is a third group (to which all the wild American species, and some of the cultivated varieties belong), in which the flowers are only provided with stamens. In this case, the pistil is more or less abortive, always incapable of functioning, and sometimes entirely lacking. The stamens on the contrary are normal and produce much pollen.

There is also a fourth group, producing pipless or almost pipless grapes. The pistils are able to develop into grapes, whereas the ovules even if they are present, cannot transform themselves into pips. The development of the fruit is caused by the stimulation exerted by the pollen tube which as it grows, penetrates into the pistil and hermaphroditism is imperfect.

There are in short 3 types of flowers: 1) with stamens; 2) perfect hermaphrodites; 3) imperfect hermaphrodites. No purely female forms are as yet known.

These flowers are not always very clearly distinguishable for there is a gradual passage from one type to the other through a series of intermediate forms. It is through the study and the selection of these intermediate forms that it may be possible to discover types possessing this degree or kind of "femininity" that is met with in the pipless varieties.

By way of preparing the ground and collecting material, the Agricultural Station of Geneva (N. Y.) made a careful study of the variations occurring in vine-flowers and the results obtained may be summarised as follows:

1) *Flowers with stamens*: in these there is either no trace of pistil, or the pistil is more or less aborted. The stamens of each flower and of all the flowers of a given plant are very uniform, but differences are noticed between one individual and another as regards length of filaments and the size of the anther. The filament is erect, the germinating capacity of the pollen in 95 % and plants of this class are typical males.

In wild species, as already stated staminate individuals frequently occur; according to observations made by the author, they seem inclined to have rather long filaments.

2) *Perfect hermaphrodites with erect stamens*: the flowers of this class may present considerable differences as regards length of filaments, size of anther, and the shape and dimensions of the pistils. Although the number of pips may vary from one variety to another, the development of the fruit is always subordinate to the formation of the pip. The stamens are erect, the pollen gives a high germination percentage, 75 %. There are, however, individuals, which although they are vigorous and well-developed and furnished with perfectly erect stamens, produced shrivelled and defective pollen.

3) *Hermaphrodite flowers with erect stamens and spiral filaments*: the filament is more or less undulating or twisted into a spiral, the anthers are normal; the pollen is more or less shrivelled and incapable of fertilising. The gynoecium on the other hand is normal and if it is fertilised with good pollen, regularly developed fruit is nearly always produced. This type of flower has been found on 33 plants of which the descent is known to the third generation.

From a cross between Winchell and Diamond (both hermaphrodites with erect stamens), Station Seedling No. 123, a hybrid also with erect stamens, was obtained. Worden (with erect stamens) was then fertilised with pollen from the above No. 123, and three other individuals, Nos. 931, 933 and 934 were produced, all having erect and straight stamens. The appearance of this type of flower in all the 34 descendants to the third generation gives a good idea of a case of mass selection.

4) *Flowers with filaments bent outwards, or with curved seeds*: in plants raised from seed it is not uncommon to find flowers of which the filaments at the moment of anthesis form a more or less wide angle with the pistil. The anthers are normal, the pollen is shrivelled and unable to germinate.

5) *Flowers with twisted anthers*: the filament may be simply bent, as in the Barry variety, or twisted to the point of being curled, as in Masasoit, with all the intermediate degrees. Pollen germination experiments give wholly negative results.

6) *Pipless or almost pipless types*. — The observations were made on plants of the type "Concord Seedless". In 1913, E. H. WETMORE of Rushville (N. Y.), sent to the Station a case of grapes which were nearly pipless. From the very small number of pips present, pipless descendants were obtained which differed from the normal type only in having rather smaller grapes. The flowers had very long stamens and normally develop-



ed anthers with pollen having a high germinating capacity (at least 95 %). The vines with pipless grapes are typical males, but the lack of pips would appear to be due, according to the author, to what may be called a slight degree of feminality. From crossing Triumph and Duches (two varieties with pipless grapes), descendants were obtained from which some of the grapes (the smallest), were almost without pips. The vines bearing these grapes have flowers with erect stamens long, or medium-sized, anthers and pistils of average dimensions.

Seedless Hubbard and Sultanina (Thompson's Seedless, a variety largely grown on the shores of the Pacific), also have flowers of the same type. The male characters are strongly developed in these varieties, whereas the absence of pips shows that the female organs are weak and only partly developed.

If a hermaphrodite variety is fertilised with the pollen of pipless types, grapes with few pips are obtained in the  $F_1$  although owing to segregation, there are no pipless individuals in the following generations.

In any case, the author is of opinion that the best way to create varieties of grapes without pips is indicated by the fact of intersexuality. Most of the individuals and varieties that are nearly or quite pipless have strong stamens. The pollen of pipless males can be used to fertilise other male individuals with weakly developed female organs that sometimes permit the formation of seed. It would no doubt be possible in this way to obtain families composed of individuals many of which would bear pipless grapes.

G A

564 — **A Monograph on the Wheat Plant** (1). *Nature* Vol 109, No 2734 pp 366-368 London March 23 1922 and reviewed in *The Gardeners Chronicle*, Vol LXX No 1827, p 331 London Dec 31, 1921.

CEREALS  
AND  
PULSE CROPS

Prof J PERCIVAL'S monograph on the wheat plant, recently published, fills one of the many great gaps in agricultural literature and is a noteworthy contribution to present day knowledge on this ever important subject. It will be read and admired in all countries and for many years to come. Every detail is founded on the author's own personal experience and the study is peculiarly exhaustive.

The introduction shows how widespread is the cultivation of wheat and it is interesting to note that there is no month in the year during which the wheat harvest is not being carried on in some part of the world. This is indicated as follows:

*January* Australia, New Zealand, Argentina, Chile, *February* India, *March* India, Upper Egypt, *April* India, Persia, Asia Minor, Lower Egypt, Mexico, Cuba, *May* Japan, China, Central Asia, Morocco, Algeria, Tunis, Texas, *June* South of France, Spain, Italy, Greece, Turkey, Japan, United States (south of 40°), *July* France, Germany, Austria, Hungary, Roumania, Bulgaria, S Russia, Canada, N United States,

(1) *The Wheat Plant, A Monograph* by John PERCIVAL, M A, F L S with 228 illustrations. London Duckworth and Co (Ed)

*August* : England, N. France, Belgium, Holland, Central Russia, Canada, United States ; *September* : Scotland, Sweden, Norway, Canada ; *October* : N. Russia, Finland ; *November* : South Africa, Argentina, Peru ; *December* : Burma, Australia, Argentina.

Apart from the great wheat producing areas, wheat can be grown from beyond the Arctic circle to the Equator ; it is known to flourish from sea-level up to 10 000 ft. in Mexico etc. and according to HUMBOLDT, reaches an altitude of 14 000-15 000 ft. in Tibet. So long as the winter temperatures do not fall below  $-20^{\circ}\text{C}$ , and the air and soil are dry, the exposed plants suffer little. As regards water supply, an annual rainfall of 20-30 in. is sufficient although some of the Macaroni and Club wheats give remunerative returns in regions where the rainfall is not more than 12-15 in. per annum.

In Part I of the monograph, Prof. PERCIVAL gives the results of his investigations into the morphology, anatomy, growth and development of the plant. The earlier chapters contain detailed descriptions of the grain and its germination illustrated by a wealth of new and admirable pictures, far more illuminating than the well-known illustrations to be found in present botanical text books. The numerous details of the structure and behaviour of the plant testify to the closeness of the observations made, and will be of exceptional value to future investigators.

Part II opens with a discussion on the classification of wheats. This is a subject which the author has made peculiarly his own, seeing that for the last 20 years he has grown annually at the farm attached to the University College, Reading all available varieties, numbering nearly 2000 forms derived from almost all the wheat growing regions of the world. As the result of his comparative investigations, Prof. PERCIVAL concludes that in addition to the two recognised wild species 1) *Triticum aegilopoides* Bal. (wild small spelt) and 2) *T. dicoccoides* Körn (wild emmer), eleven races or cultivated species exist, eight of which, viz. *T. monococcum* L. (small spelt), *T. dicoccum* Schübb. (emmer), *T. durum* Desf. (macaroni), *T. polonicum* (Polish), *T. turgidum* L. (Rivet), *T. compactum* (Club.), *T. vulgare* Host. (Bread), and *T. Spelta* L. (large Spelt or Dinkel), are well known races ; whilst three, viz. *T. orientale* (Khorasan wheat), *T. pyramidale* (Egyptian cone wheat) and *T. sphaerococcum* (Indian dwarf wheat) are new creations. The first of these consists of two emmer-like varieties, differing only in awn colour, and characterised by the possession of long glumes and grain. The second consists of a group of 5 Egyptian wheats resembling the Rivet wheats in most respects, and in leaf colour, shortness of straw and ear shape strongly reminiscent of segregates of crosses between *T. turgidum* and *T. vulgare*. The third is an equally small group of round-grained forms similar to *T. compactum*. The further sub-division of these races into "varieties" follows the well-known system in KÖRNICKE and WERNER'S "*Handbuch des Getreidesbaus*". It should be noted however that certain forms have been transferred quite rightly to other groups e. g. several forms placed by KÖRNICKE in *T. durum* are transferred to the emmer group *T. dicoccum*, and the Persian Black (*T. dicoccum* var. *persi-*

*cum*) a form which has puzzled more than one specialist is also placed in this group, to the satisfaction of those interested in the genetics of this important mildew-resisting wheat.

A specially detailed description is devoted to the common breadwheat, with the numerous bearded and beardless varieties (pp. 265-306). The predominance of these last may be attributed to the digestibility of the flour and the endurance of the plant. The most ancient of cereals, *T. vulgare* now exists in some 14 varieties (7 bearded and 7 beardless), which are easily classified by the colour and degree of downiness of the glumes.

The systematic portion of the monograph is followed by a chapter of considerable interest on the origin and relationships of the races of wheat. Evidence from various sources, archaeological, ecological, pathological, genetical, etc. is skilfully marshalled to show their probable lines of development. The author as a result of his morphological studies comes to the conclusion that "there is not nor has there ever been a prototype of the bread wheats" and that "the characters of *T. vulgare* and its allies appear... to be those of a vast hybrid race initiated long ago by the crossing of wheats of the emmer series with species of *Aegilops*." He adopts the view that the present day wheats fall into the 3 series already mentioned. The multiplicity of the races is doubtless connected with the fact that, although as a rule self-fertile, wheat is occasionally cross-fertilised and results in consequent natural hybridisation.

Artificial hybridisation was first started at the end of the XVIIIth century by KNIGHT, but no definitely important results were obtained until 1846 when MAUND and RAYNBIRD produced undoubted hybrids. Since then, hybridisation has been carefully followed up and important results have been obtained. For example, BIFFEN, who first investigated the inheritance of resistance and susceptibility to the attacks of yellow rust (*Puccinia glumarum*), discovered that these characters form a Mendelian allelomorphic pair, and working on this basis, a means of circumventing rust by the production of immune varieties was worked out (1). A useful summary of most of the more important literature dealing with hybridisation and improvement of wheat is given, with details of the most recent hybrids obtained.

The concluding chapter contains an interesting survey of the yield obtained in different countries, the world's average being 13 bus. per acre. Historical research shows how greatly the yield has been increased during the last few hundred years. With the increase in stock raising and the consequent increase in the amount of manure available, there has been a steady rise in yield. Records show that in the XXth century, the average for the first 20 years was 31 bus. as compared with 10 bus. in the XVIIIth century. Occasionally there have been exceptional results: e. g. 96 bus. per acre of Yeoman wheat at Wye, Kent (England), in 1918 and 117.2 bus. per acre in Island County (Washington, U. S. A.) in 1895.

(1) See *R. March* 1922, No. 226. (*Ed.*)

Prof. PERCIVAL also gives details of the effect on yield of soil, cultivation and manuring, seed rate, variety, time and methods of sowing, and size of grain. M. L. Y.

565 - **The Chief Causes of the low Yields of Maize in South Africa and possible Means of Improvement.** — BOSMAN, G. J. (School of Agriculture, Glen, O. F. S.), in *Journal of the Department of Agriculture, Union of South Africa*, Vol. III, No. 6, pp. 507-514. Pretoria, Dec. 1921.

In recent years, the average yield of maize per acre in South Africa has been very low as compared with other countries. The author has here summarised the main causes of this deficiency, and the methods recommended for the cultivation of maize.

Apart from the employment of defective methods of cultivation, the rainfall of South Africa is undoubtedly the greatest limiting factor in maize production. It is considered, other factors being favourable, that 10 to 12 in. of rain during December-February are sufficient, and a steady rainfall of 1-2 in. per week seems to be the most effective. It is noted, however, that although the question of moisture is to a large extent beyond the control of the farmer, the proper preparation of the seedbed is a matter for careful consideration. A great deal of the maize crop, in South Africa suffers annually because the soil is simply surface scratched and the roots are unable to reach the moisture conserved in the sub-soil. Deep ploughing is considered advisable by the author, preferably a winter ploughing with a subsequent cross ploughing in spring, or where this is impracticable, the soil should be thoroughly cultivated or disc-harrowed. Maize does not succeed well on newly broken up soil, unless of a very sandy type.

Seed of poor quality has largely been used. Maize farmers have obtained their seed behind the sheller, where the large grains from the small degenerated ears are caught as well as those of good ears. This has gradually led to deterioration in crop value. To remedy this mistake, it is recommended that new seed of the same variety should be obtained and used in every alternate row. The continuous use of the same variety without introducing the "vigour" of a different strain is deleterious to the crop. By detasselling the plants from the old seed every fourth year, the vigour and stamina of the crop are assured.

Many farmers sow their seed broadcast and the disadvantages of this method are numerous, particularly when the difficulties of labour shortage are also considered. The greatest economy in seed is gained where the planter is used. To ensure adequate depth for planting the "listing" method is advised (i. e. the use of the ridging plough) and it has been proved that listed maize stands drought far better than maize planted in the ordinary way.

The insufficient use of the harrow has led to a very marked diminution in yield, and attention is drawn to the fact that a weedy field is doomed to failure in times of drought.

Another cause of crop failure may be attributed to inadequate knowledge of the right crop rotations. The following rotation as suggested by the author should, however, meet the requirements of most maize farmers :

*For a grain farmer on poor soil* — 1st year maize, fertilised, 2nd year, maize, 3rd year, cowpeas ploughed under

*For a maize farmer on more productive soil* — 1st year maize fertilised, 2nd year, maize, all available manure applied, 3rd year maize, 4th year cowpeas or velvet beans ploughed under

*For the stock farmer who grows maize* — 1st year maize, 2nd year, maize fertilised, 3rd year hay crop e.g. teff (*Eragrostis abyssinica*), Sudan grass etc., 4th year, cowpeas harvested for hay

*For the potato and maize farmer* — 1st year maize, 2nd year maize fertilised, 3rd year cowpeas, ploughed under 4th year potatoes heavily manured

*For the cotton and maize farmer* — 1st year maize fertilised, 2nd year cotton, 3rd year Kaffir beans, peanuts or velvet beans

There appears to have been a continued persistence in growing unsuitable varieties of maize, and in unfavourable zones. Large areas situated in a dry region have been planted with maize every year with the result that the crop is a success only once in 3 or 4 years. In such cases the author states that the substitution for maize of a more drought resistant crop such as Kaffir corn, would be distinctly advantageous. It is questionable whether maize should be grown in areas receiving a rainfall of less than 23 in a year.

Another mistake has been to grow late varieties in totally unsuitable districts.

Farmers in the drier districts where the growing season is short on account of the altitude or late arrival of the rain, are advised to cultivate the Flint varieties in preference to the Dents. Strict attention should be paid to local conditions as climatic influences cannot be made to suit the variety selected.

In consideration of the labour shortage it will probably be advisable to adopt an increased use of machinery and the so called combined harvester and binder and the maize husker are recommended. By this means the land is cleaned and made ready for winter ploughing the danger from insect pests is greatly diminished and the fodder can be stacked and saved as winter feed for stock.

With the maize husker the ears are snapped off, the rest of the plant being left standing. From 8 to 10 acres can be harvested in one day. Up to the present this machine has not been given a trial in South Africa.

Thousands of bags of maize are lost through the ravages of wild animals and it is stated that the only effective way of dealing with these pests is to use strychnine baits etc. The losses due to insect pests, especially the stalk-borer (1) are estimated at 25 % of the crop and 1 ½ million pounds sterling per annum.

M. L. Y.

(1) (*Paparpema niella*) The best means of combatting this pest successfully are described in Bulletin No. 3, 1920 Dept. of Agriculture, Union of South Africa (author's note)

566 - An Experiment with *Sorghum vulgare* from the Bombay Presidency, in the Singapore. — MATHIEU, E. H., in *The Gardener's Bulletin, Straits Settlements*, Vol. II, No. 12, pp. 423-426. Singapore, Aug. 5, 1921.

Report of experiments made in Singapore with two samples of *Sorghum vulgare* called Ahmednagar, and Jalgaon sent from the Bombay Presidency for trial purposes. The first proved of little value as a cereal crop, although possible of some value as forage. The Jalgaon sorghum however gave a comparatively closely packed head and may be considered of economic value as a cereal. It is to be noted that this plant, which comes from a region in India where the rainfall is light, has succeeded under very diverse climatic conditions elsewhere.

The prevalent idea that sorghum will not readily stand transplanting, has been contradicted by the results obtained during the present experiments. The results of the first cutting was :

Sown plot . . . . .	142 stems	weight with leaves, 31 lb.
" " . . . . .	142 panicles	" 8.75 lb. giving 5 lb. dry grain.
Transplanted plot . . .	223 stems	" with leaves, 102 lb.
" " . . . . .	223 panicles	" 23.75 lb. giving over 15 lb. dry grain.

The plots were identical in size, 280 sq. ft. planted 12 × 12 inches.

Yield per acre up to the present in Singapore is estimated at 714 lb. dry grain. The abnormal yield on transplanted plots is, however, worthy of notice.

A most effective means of scaring birds is described as follows : a skin of a flying fox is stretched out at full length on a bamboo frame, half rigid and half flexible, attached at both ends to the tips of the extended wings. The main bamboo is slightly bent like a bow, so that when grasped in the middle and moved about, the wings, following the movement of the bamboo, appear to be actually in flight. The scarecrow is attached to the top of a pole in the middle of the field and worked by a cord from a distance.

The sugar cane borer (*Scirpophaga* sp.), aphids and weevils have also done some damage to the plants but have been easily controlled.

M. L. Y.

FORAGE CROPS,  
MEADOWS  
AND PASTURES

567 - Sugar Sorghum a good Rust-resistant Feed. — CONSOLANI, G., in *Il Coltivatore*, Vol. 68, No. 8, pp. 246-248. Casale Monferrato, March 20, 1922.

The author calls attention to the usefulness of the sugar sorghum as a feed which can be grown in damp places owing to its resistance to rust, as proved by experiment with the "Silver Tip" variety; it also keeps its intense green colour throughout the period of vegetation in localities where maize-feeds and second-crop seed maizes, suffered greatly from the attacks of *Puccinia*.

Its other well-known qualities should also be taken into account, viz., its composition, high yield and resistance to rust.

The author advises sorghum as a feed for milch-cows especially (20 to 25 kg. per head per day, completing the ration with hay and oil-cake); the milk yield is considerably increased by its use.

F. D

**568 - Star Grass (*Cynodon plectostachyum*), a valuable Fodder Grass in South Africa.** — STENT, S. M. (Assistant Botanist) and MELLE, H. A. (Officer in Charge of the Botanical Experiment Station, Groenkloof) in *Journal of the Department of Agriculture, Union of South Africa*, Vol. III, No. 3, pp. 271-276, figs. 4. Pretoria, Sept. 1921.

The Star grass (*Cynodon plectostachyum*) is a native of East Africa, and has only recently been introduced into the Union of South Africa for experimental purposes. It has been grown at the Botanical Stations both in the valley on moist soil and on the dry-soil section, and reports have also been received from certain farms, all with reference to the pasture value of this plant.

In the Transvaal it is stated that this grass has proved a most valuable summer pasture but should not be relied upon in winter. This report was confirmed in Southern Rhodesia, and in addition it has been found in Nairobi that *C. plectostachyum* has proved more resistant to drought and of richer feeding value than kikuyu grass (1).

According to the chemical analysis made by the Government Chemist at Pretoria, the grass contains : % water 69.46, protein 5.50, fat 1.01, fibre 7.76, ash 2.89 and carbohydrates 13.38.

No extensive feeding tests have so far been made, but certain preliminary trials have shown that livestock appear to appreciate the flavour.

As regards cultivation, conservation of soil moisture is an important point and the plant has much difficulty in withstanding weeds.

An economical method of planting has been to use rooted plants and runners and plant behind the plough.

After harvesting with a mower there are generally three days interval before it can be stacked and it requires constant stirring. Experiments have shown that the best time to cut is between flowering and seed setting. A six months growing period should be allowed.

Owing to the soft and succulent nature of the plant it takes a considerable time to cure but gives a very good quality of hay. For economic purposes however it is recommended as more suitable as a pasture grass than as hay.

M. L. V.

**569 - Cultivation and Forage Value of the Velvet Bean (*Mucuna utilis*) in Rhodesia.** — WALTERS, J. A. T. in *The Rhodesia Agricultural Journal*, Vol. XIX, No. 1, pp. 21-28. pl. 3. Salisbury, Feb. 1922.

Twelve years of experimental trials in Rhodesia with the velvet bean (*Mucuna utilis* = *Stizolobium deeringianum*) have proved its high value as a forage crop and as a green manure. The two varieties employed viz. the Florida and the White Stingless are both long season crops (5 months).

Experiments were made to ascertain the value of sowing with maize, and it appears that for ensilage purposes this method is very satisfactory and especially if either sown simultaneously or at an interval of from 7 to 14 days (but not more) between the crops. The advantage of sowing the maize before the bean is that a support is thus provided for the twining

(1) *Pennisetum longistylum*. (Ed.)

vines. For grain purposes, similar trials were made, the beans and maize being sown alternately at a distance of 15 in. in the rows (*i. e.* half a stand of each). Both were sown on the same day in November, and resulted in a yield of 2862 lb. of maize, and 576 lb. of velvet beans per acre this following a very exhausting crop of buckwheat the preceding season.

**YIELDS AND HARVESTING.** — Good quality velvet bean hay is estimated to contain 14 % protein, and is therefore of almost identical value as a stock feed as lucerne hay (14.3 %). Green weights taken at the Agricultural Experiment Station, Salisbury show a yield of about 6.5 tons per acre which usually dries out to about 1 ½ to 2 tons of hay. Excessive drying should be avoided.

For seed purposes four separate experiments made at Salisbury in 1920-21 showed yields of 1270 lb., and 1210 lb. for pods + seeds and 1116 lb. and 880 lb. for seeds only per acre.

In America it is usual to feed the bean entire, either crushed or soaked for 24 hours, and its nutritive value is evident: protein 18 %, fat 4 %, nitrogen free extract 48 %, fibre 14 %.

Interesting results have been obtained where this crop has been systematically employed as a rotation legume with maize. Used as a green manure, there has been a distinctly higher maize yield. A chemical analysis made in 1921 indicates that when the velvet bean crop is ploughed under, the material above ground (excluding the root system) contains nitrogen 3 %, phosphoric oxide 0.47 %, potash 1.7 %, equal in a green crop of 6 ½ tons per acre to 191 lb. 30 lb., and 108 lb. respectively. Compared with other crops ploughed under, it is shown that the resulting yields of maize are superior to those where sunn-hemp (*Crotalaria juncea*) etc. are employed.

The high value as a stock feed has been confirmed in the United States, and LINDSEY and BEALS of the Massachusetts Agricultural College report that cows receiving a 40 % velvet bean ration gave an average of 5 % more milk than while on wheat bran ration. For pigs a ration of 20 parts. velvet bean feed + 20 pts. high grade peanut meal + 50 pts. maize meal + 10 pts. alfalfa was found satisfactory; for horses 20 % velvet bean + 30 % oats + 40 % cracked maize + 10 % wheat bran. It appears, however, that it is preferable to use the meal (bean minus pods) for pigs and horses.

M. L. Y.

#### FIBRE CROPS

570 — **A new Flax Seed in Ireland giving an exceptionally High Yield of good Quality Fibre.** — In *Journal of the Royal Society of Arts*, Vol. LXX, No. 3619, pp. 360-361, London, March 31, 1922.

A new pedigree flax seed has recently been produced by Dr. VAGAS EYRE, Director of the Linen Research Association Institute at Lisburn, near Belfast. Two new varieties of the Livornian strain were discovered, which on being tested, gave 80 % more fibre than any other flax seed on the market and the quality was on the average two grades higher.

It is estimated that the return is 100 % better than from the Dutch flax seed hitherto grown and it is reported by a well-known linen manufac-



turer that the spun yarns are of a more uniform quality. At present there are approximately 5 tons of this seed available.

Further distribution and commercial utilisation is under consideration, and while a portion will be given to Irish flax growers, another portion will be forwarded to the National Institute of Agricultural Botany at Cambridge, and the remainder sent to Canada, where climatic conditions are favourable for seed development.

M. L. Y.

571 - **Note on the Culture of the Cotton Plant in Tunisia.** — (Communicated by M. LOUIS-DOR, Delegate for Tunisia at the International Institute of Agriculture.

The cotton plant has not been much cultivated in Tunisia. The growers have limited their efforts to trials on a larger or smaller scale, assisted by the collaboration of the Board of Agriculture

**EXPERIMENTS CULTIVATION.** — The first attempts in the culture of the cotton made in the Experimental Garden date from 1899-1900-1901. They were not followed up at that time by the Tunisian agriculturists.

They were resumed by the Experimental Garden, the Colonial School of Agriculture and the Botanical Department in 1906 and continued until 1915. They had to be abandoned in 1916 owing to the mobilisation of the staff of these establishments

These trials were directed to the methods of culture and the varieties to be adopted in Tunisia. The results were published in the *Bulletin officiel de la Direction Générale de l'Agriculture*.

**SELECTION OF VARIETIES** — The tests having shown that the varieties cultivated were mixed, and this being against their adoption and detrimental to the quality produced, the Board of Agriculture proceeded to make a methodical selection.

This was done in two ways :

1) In 1912 and 1913, the Board made a contract with various planters authorising them, on payment of an indemnity, to take up from the land under cultivation all stocks which were not of pure growth and to keep the seed.

2500 kg. of selected seed were thus procured in 1912 and about 1500 kg. in 1913.

2) The work of scientific selection has been carried on by the Botanical Department since 1912 for the purpose of obtaining perfectly pure types to be afterwards multiplied and substituted for the varieties cultivated.

**PUBLICATION OF NOTICES ON COTTON CULTURE.** — In addition to making known the results obtained in their research establishments, the Board of Agriculture has published various pamphlets giving information to the planters as to the best methods of cultivating the cotton plant and the results obtained in neighbouring countries. These pamphlets are :

*Considérations générales sur la culture du coton en Tunisie.* — BRABANT ET NARLIN, 1911.  
*Notice sur la culture du coton en Tunisie,* VERRY, Inspector of Agriculture, 1912  
 18 p. *Rapport sur la culture du coton en Algérie.* — VERRY, Inspector of Agriculture, 1912. *La culture du coton en Egypte :* Ahmed el Alfî. Translated by SIBLOCH et LEPINEY of the Tunis Board of Agriculture, 1913, 134 pp.

**FREE DISTRIBUTION OF COTTON SEED.** — In order to surmount the difficulty experienced by planters in obtaining cotton-seed and to prevent the introduction of parasites, the Board of Agriculture has introduced all the seeds necessary for planters and has ensured their free distribution and disinfection.

With the seed distributed the following approximate areas have been sown :

15 hectares in 1906			50 hectares in 1911		
6	"	1907	200	"	1912
10	"	1908	800	"	1913
8	"	1909	100	"	1914
5	"	1910			

Of the area sown a portion, more or less considerable according to the year, remained unproductive, cultural results being very uncertain in soil which is not irrigated.

Since 1910 the attempts at cultivation on a large scale have been abandoned. From the results of the trial period we may conclude : that it is possible and advantageous in irrigated soil, which is however scarce in Tunisia ; and that its successful culture is uncertain in soil not irrigated. The profitable culture of cotton is only possible with high prices ruling.

To sum up, the practical trials in Tunisia, have, up to the present, shown that the growing of cotton in dry ground does not ensure sufficiently regular profits to enable it to compete with that of cereals or the vine. The area at present irrigated is small and occupied by fruit (dates) or vegetable crops which are more remunerative than cotton.

**572 - Cotton Ratooning Experiments in South Africa.** — OOSTHUIZEN, J DU P (Assistant Chief, Division of Tobacco and Cotton) in *Union of South Africa, Journal of Agriculture*, vol IV, No 2, pp 125-131 Pretoria, Feb 1922

Although ratooning is considered an undesirable method both in the United States and in Egypt, it was decided to give this cutting back of the old cotton stalks instead of planting afresh, a thorough trial in South Africa, in order to obtain reliable information as to the effects under the prevailing climatic conditions.

Experiments have been conducted at the Rustenburg Experiment Station in order to ascertain : 1) whether increased yields could be obtained by ratooning ; 2) whether the quality of lint would be deteriorated ; 3) whether any noticeable difference in the number of insects and their attacks was evident between first year crops and ratooned fields. With a view to reference as regards climatic conditions, figures are given indicating the rainfall and frosts during the years of experiment.

According to the results obtained from the 3-year tests made between 1917 and 1921, the 1<sup>st</sup> year yields were in nearly every case obviously the largest and the second and third lower in order of sequence. This was the case with both the varieties tested viz. Improved Bancroft and King. Where increased yields have been obtained on ratooned fields

by farmers in the surrounding district it is considered that in all probability some other factors, such as season, cultural methods etc. are responsible and the increase should not be attributed to the actual ratooning itself.

The lint from the three respective years was carefully examined and an examination of the grading table indicates that the lint from ratooned fields shows signs of deterioration, although this is not marked. However the silkiness of the first year cotton certainly showed a superiority compared with the somewhat coarse ratooned cotton.

Counts were made of the number of bolls attacked by the cotton bollworm (1), the most serious existing pest in South Africa, and it was found that, as a general rule, ratooned fields are more infested than first year cotton

M. L. Y.

573 - **Cultivation of Coconut Palms and Production of Copra in Dahomey, French West Africa.** — HOUARD, L. (Chef du Service de l'Agriculture du Dahomey), in *Bulletin des Matières Grasses de l'Institut Colonial de Marseille*, No 2 (1921), pp 25-35. Marseille, 1921

PLANTS  
YIELDING OIL,  
DYES, TANNING  
ETC.

For the last 10 to 15 years, the area devoted to the cultivation of coconut-palms has gradually become extended in the various districts of Dahomey, but the possibilities have been somewhat limited owing to the lack of manual labour and funds, and also the difficulties of obtaining suitable tracts for commercial enterprise. It is hoped, however, to urge the direct support of an Exploitation Society which will put matters on a better footing and which should result in a marked increase in copra production, giving better quality material and bringing about the utilisation of saleable products hitherto abandoned owing to lack of machinery etc.

After a general survey of the existing areas in Dahomey as a whole, the author estimates the present total number of existing palms as 150 000 and possibilities as regards coconut planting etc. as about 1000 000 trees. It is stated that should these new plantations be made, under favourable conditions, it may be expected to count on increase of 20 000 to 30 000 plants per annum, and working on this basis, after 30 years, the maximum number of palms will be established.

Observations made as to the type of soil etc. especially suited to the coconut palm have led to the conclusion that, although sandy soil on the coast line covered with thickly growing woody shrubs is evidently the most desirable, palms growing on similar territory from the physical standpoint but hidden completely with savannah grass, develop slowly and yield practically nothing. This fact is worth notice and explains the reason why certain well known savannah grass districts should be avoided for coconut planting.

Methods hitherto practised by the natives have been replaced by other up-to-date methods suggested by the Agricultural Service. The land reserved for coconuts is cultivated for the 2 previous years with manioc thickly

(1) *Heliothis armiger* (Ed)

sown, not so much to obtain a maximum yield as to choke the weeds which are very prevalent. Occasionally manioc has been substituted by a Cucurbitacea, the seed of which is used in the preparation of "goussi" oil. Wider spacing has been encouraged (7 to 8 m. each way) and also the transplanting of seedlings in preference to sowing *in situ*. Runner beans are largely grown as a cover crop when the palms are still at an early stage of development.

Certain cultivators near Agoue, the principal cultivation centre, have utilised with success old cottonseed (waste material from the mills) as a fertiliser dug into the ground about 150 m. from the palm.

A well developed plant is estimated to give an average yield of 60 to 80 nuts per annum. It is considered that 7 nuts will give 1 kg. of sun-dried copra. Improvements as regards the actual preparation of copra are in progress and should result in the production of superior quality material.

Normally the exports vary between 200 and 300 tons per annum. In less than 10 years according to the plans put forward with reference to young plantations it should be possible to count on an annual output of 1200 to 1400 tons.

The local consumption of the green nuts should be considered and this absorbs a large portion of the yield but this will have no evident effect on the yield from the new plantations reserved essentially for export purposes. Up till now the by products (coir etc.) have not been utilised and the husks have been burnt. The exploitations have been so limited in extent that the value of the by products has not been recognised by the natives and it has not been considered advisable to purchase the necessary machinery.

M. L. V.

#### 574 - The Tannin Content of some South Indian Wattles (*Acacia* spp.). -

SRINIVASAN, K. C. (Consulting Glue Chemist, Department of Industries, Madras) in *Journal of the Royal Society of Arts*, Vol. LXX, No. 3622, pp. 406-412, London, April 21, 1922.

Results of an investigation of the tannin content, optimum temperature of extraction and tanning properties of the bark of *Acacia decurrens* found in South India, and discussion concerning the wattle extract industry in relation to wood distillation.

Analyses of samples of air dried bark from full-grown trees were made and the results compare very favourably with those of other countries. The tannin was easily extracted, the optimum temperature was about 60°C when the proportion of non-tans to tans was about the smallest and most of the tannin is extracted.

According to the results obtained, the value of the bark is variable with respect to age. Barks from branches of trees of one, two, three, four and five years were taken and the percentage of tannins was 18.37, 24.37, 25.97, 27.62 and 29.07 respectively. It was also found that the thicker the bark, the higher the tannin value. Exudations of gum are valued at about £110s. per cwt.

Laboratory experiments on the spent bark of the high range wattles showed the possibility of producing about 30 % of good pulp with fine felting properties, readily bleached to an attractive ash colour. It has been reported that this spent bark contains 41.2 % cellulose, and the length of the fibre is about 1.2 mm., the latter is variable.

The wood of the wattle is estimated to yield about 61 % cellulose and 50 % pulp capable of utilisation in the manufacture of straw-board. Most promising results have been obtained during the destructive distillation trials. The ash is also of high economic value. Moisture 9.80 %, combined moisture 3.61 %, potassium carbonate 8.77 %, sodium carbonate 2.10 %, calcium carbonate 77.50 %, calcium phosphate 4.60 %.

It is considered by the author highly probable that with the scientific plantation of the most valuable species of *Acacia*, the possibilities of the establishment of important industries such as the manufacture of tannin extracts and of wood distillation will be realised. M. L. Y.

575 - On the Influence of Tar on Hevea Bark. - GANDRUP, J., in *Archief voor de*

RUBBER GUM  
AND  
RESIN PLANTS

Investigations were made in Java on the influence of tar on hevea bark which had been scraped out to different depths. The tar was applied partly warm and partly cold. Coal tar and another preparation made by the Dordtsche Petroleum Maatschappij called "Cambisan" were used. Scraped untarred portions were left on each tree for control purpose.

Results showed that the tar had no influence on the renewal of the scraped out bark spaces, and the reforming of the cellular tissues, cork and latex vessels showed no difference on the tarred and untarred spaces.

When, however, the trees were scraped to a depth of the usual tapping cuts, the coal tars killed the remaining bark up to the wood, but the "cambisan" had no influence excepting that to a certain extent, it hindered the drying out of the outer layers of cells lying exposed. It has therefore been recommended to avoid tarring the tapping surface, and to apply the tar only where the wood is exposed. For the control of pink disease (1) and die-back disease (2), the use of "Cambisan" tar is advised, as it remains for months forming a layer of tough solution and prevents the attacks of boring beetles. Black-thread canker (3) should not be treated with tar as it appears to cause larger wounds than those actually made by the disease itself.

These investigations are to be continued with brown bark diseased trees with the object of trying the system of treatment proposed by HARMSEN, viz : the scraping out of the bark and treating it with warm tar.

M. L. Y.

(1) Caused by *Corticium salmonicolor* and *C. javanicum*. (Ed.)

(2) Caused by *Diplodia* sp.

(3) Caused by *Hymenochaete noxia* Berk. (Ed.)

STIMULANT,  
AROMATIC,  
NARCOTIC AND  
MEDICINAL  
PLANTS

- 576 - **Cacao Cultivation in Grenada.** — WILLIAMS, R. O. (Curator, Botanical Department, Trinidad and Tobago, formerly Supt. of Agriculture, Grenada), in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XIX, Pt. 4, pp. 215-223. Trinidad, 1922.

Report on the various methods of cultivation of cacao employed in Grenada and the treatment of the insect pests prevalent in that neighbourhood. A comparison is also made with the methods adopted in Trinidad.

Apart from the generally recognised cultural operations, certain points are of especial interest to planters elsewhere. Attention is called to the question of temporary and permanent shade and the value of certain windbreaks. For temporary shade purposes, bananas, plantains, canes, etc. are used, but it is of interest to note that, in contrast with the usual permanent shade planting employed in other countries on cacao plantations, in Grenada, this is dispensed with and in its place much more attention is given to cultural operations, such as drainage, forking, manuring, etc. and a consequent preservation of good soil tilth, which appears to give very satisfactory results. If this idea of replacing organic matter naturally associated with prevailing climatic conditions, can be maintained economically, the author considers it preferable to using shade plants. It was observed that the loss from pod rot was minimised to a marked degree and this fact alone should more than compensate for extra expense and labour. It should be mentioned however, that in certain fields plants such as mango, breadfruit, etc. are cultivated and although these can only be designated as partial shade trees, their economic value is an important consideration to the grower.

The great value of carefully selected windbreaks has been fully recognised and the principal tree used for this purpose is the "galba" (*Calophyllum Calaba*) whilst almond (*Terminalia Catappa*), cashew (*Anacardium occidentale*) and mango (*Mangifera indica*), are used to a lesser extent. Protection is also afforded by hedges, and the "galba" and wild coffee (*Aralia Guilfoylei*) are chiefly used for this purpose.

As regards manuring, large quantities of farmyard manure are applied regularly, and a system of herding cattle in various parts of the field is practised. Horse beans (*Canavalia ensiformis*) have been sown and turned in as green manure or left as a mulch with satisfactory results on some of the best estates. An advantageous system has been found by which fields are treated the first year with farmyard manure, the second with leaves and sweepings, the third in the same way and if possible mulched, in the fourth, artificial manures are employed and in the fifth lime is applied before starting a repetition of the rotation.

The yield per acre in Grenada is estimated at 720 to 900 lb. which compares favourably with Trinidad, etc.

M. L. Y.

- 577 **Cinnamon: Sources, Production and Trade.** — *Bulletin of the Imperial Institute*, Vol. XIX, No. 3, pp. 319-348. London, 1921.

There has been a growing demand for cinnamon bark as a spice, and for the distilled oil for medicinal purposes. The entirely distinct and

cheaper oil distilled from the leaves is in still greater demand, largely as a source of eugenol and for the manufacture of vanillin

Up to the present, it has been agreed that cinnamon bark grown and prepared in Ceylon is by far the best for Western commercial purposes, but recently much of the area occupied by cinnamon has been replaced by coconut, Para rubber etc and the question has arisen as to the possibility of meeting the increasing demand from other sources. It appears, however, that *Cinnamomum zeylanicum*, the bark of which is considered to give the best quality cinnamon cannot be relied upon to reproduce in other countries the characters for which it is noted in Ceylon, even under very similar conditions of climate and soil. At the same time bark obtained elsewhere, which has not received the elaborate treatment of the Ceylon product may produce a large amount of good quality oil, as for example in the Gold Coast. The present article gives a detailed account of the present production of cinnamon throughout the world in order to indicate its future possibilities.

Firstly a description is given of the botanical sources of cinnamon and throughout the article interesting historical references are given as to early cultivation etc in each country. This is followed by details as to the characters and composition of cinnamon oils obtained by distillation of the bark. It is of interest to note the general relative value of some of the species described —

*C. zeylanicum* (native of southern India, Tenasserim and Ceylon) — Aldehyde from bark 58 to 76 %, from root bark only a negligible quantity is obtained and a small % of eucalyptol, eugenol, safrol and borneol, the leaf oil contains 70 to 75 % eugenol and 3 % cinnamic aldehyde.

*C. Cassia* Blume — A similar yield from all parts of the plant. Aldehyde from 80 to 90 % oil from twigs and leaves from 0.5 to 2 % aldehyde eugenol nil.

*C. Loureiri* Nees — Oil from root bark 1.17 %, leaves and shoots 0.2 %, containing 27 % aldehydes, 40 % linalol, eugenol and eucalyptol.

*C. Burmanni* Blume (= *C. Kiamis* Nees) — aldehyde 77 %, eugenol 11 %.

The following species contain little or no aldehyde and are utilisable only for their camphor and safrole content: *C. Camphora* C. Oliver, *C. Parthenoxylon*, *C. pedatinervium*, *C. Mercadori*, *C. Sintok*, *C. Lamala*, and *Canella alba*.

## WORLD PRODUCTION OF CINNAMON AND ALLIED BARKS

### I — BRITISH EMPIRE

CEYLON — *Cultivation and preparation* — The most satisfactory results have been obtained on a very sandy clay or fine white quartz sand with a good rich sub-soil, at altitudes of less than 1500 ft, on the S.W. coast between Negumbo, Colombo and Matura where there is an average temperature of about 85° F and a rainfall of about 85 in annually. Lateritic gravel has produced a quicker growth with coarser bark, and marshy

land has given an undesirable bitterness to the product and a much lower oil content

Better quality bark has been produced if the trees are freely exposed to the sun. As regards cultural operations manuring with coconut "poo-nac" or cowdung has proved beneficial.

Four or five shoots per stool are allowed to grow for about 2 years (6-10 ft high) before cutting begins.

The trees are comparatively resistant to diseases and insect pests, *Pestalozzia cinnamomi* Raciborski on the leaves and twigs and *Corticium salmonicolor* B and Br on the stem are the only two notified, but are not difficult to control. Mites of the genus *Friophyes* have caused some damage, but a Braconid hymenopterous insect probably parasitic on the mites has been observed.

*Production and exportation* — The decrease in area under cultivation and the consequent decrease in export is brought out clearly by the figures given. The 47 906 acres under cinnamon in 1909 shows a steady decrease to 34 662 acres in 1920. The export of bark and bark oil has therefore been on the downgrade ever since and in 1920, amounted to 3 933 552 lb and 73 246 lb respectively for quills and chips. There has, however, been a certain rise in the export of leaf oil, and for 1920 the return was 365 976 lb.

The quantity exported to the chief countries in 1913, 1919 and 1920 is shown in tabular form and also the annual amounts exported and the estimated value from 1909-1920.

The figures certainly suggest the importance of turning attention to production elsewhere.

**INDIA** The leaves are obtained principally from *Cinnamomum lamala* Nees and Eberm and var *intermedium* a species found wild in the tropical and sub tropical Himalayas at altitudes of 3000 to 9800 ft. The leaves distilled in Mysore come from another species possibly *C macrocarpum* Hook fil (1) which is stated to grow abundantly at 100 to 700 ft and is found also up to 3500 ft. This species grows well from self sown seed and stands any amount of rain and shade. Very little bark is collected from these two and the leaves only are utilised. In Bengal the species *C obtusifolium* is utilised for root bark which is reputed to be as aromatic as the best Ceylon cinnamon (2) the grey bark on the contrary, varies considerably in aroma.

There is no evidence of the cultivation on any commercial scale of the true cinnamon (*C zeylanicum*) but according to some of the best authorities after careful study of the various characteristics associated with the different species it seems probable that *C obtusifolium* etc may be classed as forms of *C zeylanicum*.

**SLYCHFLIES** — The distillation of oil from wild bark and leaves

(1) Referred to in *Indian Forests* Vol. 47: 77 1913, as *C zeylanicum* (Author's Note)

(2) See WATTS, *Dictionary of Economic Products of India*, Vol II p. 318 (Author's Note).



was begun in 1906, and a sample tested later was found to yield 21.7% of cinnamic aldehyde and 8% eugenol, but to differ distinctly from the bark oil of commerce.

Experiments proved that dried bark gave more than twice the amount of oil than from fresh bark and of a more agreeable odour the yield however, was strictly dependent on the season when collection took place the second or third week of rains giving the best results. Since 1916 attention has chiefly been devoted to the production of leaf oil. There were only 12 distilleries in 1915 as against 44 in 1920 and the export amounted to 15 669 and 39 507 litres respectively. It was estimated that the total output of leaf oil in 1920 was 50 000 litres.

No details are given as to the varieties cultivated.

**MAURITIUS** — Samples of bark and leaves on examination gave 0.8% of oil of fair quality, considered as of equal value commercially with Seychelles bark. The leaves gave 1.1% of oil also of fair quality. Neither the cultivation of cinnamon nor the distillation of its oils seems to have been developed in Mauritius.

**MALAYA** — A favourable report was made with reference to the bark sent to England to be tested very many years ago but cultivation has not been continued probably owing to low prices prevailing. Amongst the wild species found in the Malay region are mentioned *C. laccivanum*, *C. Parthenovylon* and *C. Culilayan* Blume (*Clove bark*) a native of the peninsula and the islands. The bark is grey smooth externally, interior yellowish brown very aromatic but the strong clove scent suggests a high percentage of eugenol. So far its sole use commercially has been confined to the use of the calvices of the fruit in medicine and curries.

**FIJI** — Both *C. zeylanicum* and *C. Cassia* have been grown successfully from seed and the bark and leaves distilled on an experimental scale at Naisumu. The plants seem to have become naturalised very readily. The species *C. pectinervium* Meisn (*Vassoria aromatica* Beccari) gives the well known Masaka bark of Fiji and New Guinea. This bark contains crystals of calcium oxalate similar to those produced by *C. Cassia* and is very aromatic.

**AFRICA** — Cinnamon has been grown experimentally at the Tarquah Agricultural Station in the Gold Coast and the bark submitted for examination in 1917 proved to possess an inferior quality aroma and flavour but the yield of oil was about half as much again as from Ceylon bark and was estimated to contain 68% of aldehyde. Three samples tested later and coming from the Achanti, Coomassie and Aburi Stations gave equally good results on distillation, with a 61.70% aldehyde content. Cinnamon is grown for local consumption in Zanzibar and experiments have been made in the Botanic Garden at Entebbe (Uganda).

**WEST INDIES** — Since 1782 cinnamon has been grown in Jamaica but not on any wide scale. The bark obtained from *Canella alba* has been utilised in Europe in the drug trade, but is in no way related to *C. zeylanicum*. *C. alba* is a native of Florida and the West Indies and is now mainly shipped from New Providence in the Bahamas under the name of "white

wood bark" and "cinnamon bark" (formerly known as "Jamaica winter bark" and "*Cassia lignea*").

## II. — OTHER COUNTRIES :

CHINA. — *C. obtusifolium* appears to be the only species utilised. It is found growing wild up to altitudes of 7000 ft. *C. Cassia* (unknown in the wild state) and *C. Loureirii* are only varieties. The best Chinese cassia is said to be produced from cultivated trees near Taiwu in Kwangsi (about 180 miles west of Canton). The first cut of bark is made when the trees are about 6 years old. The tree seems more readily adaptable to change of soil and climate than *C. zeylanicum*, and the bark might probably be so prepared as to equal Ceylon cinnamon in appearance. In microscopic structure these two barks are very similar except that the Chinese bark possesses a covering tissue rich in oil ducts over the sclerenchyma (which is the outermost layer in ordinary scraped cinnamon) and from this it may be inferred that the flavour of the drug could not be improved by scraping the bark.

*C. Burmanni* Blume, occurs wild to a small extent, but does not appear to have been either cultivated or barked.

FRENCH INDO-CHINA — It has been reported from various sources that apart from Indo-China, there has been a tendency for cinnamon culture to disappear from the French colonies, but the produce from Annam has been gradually increasing and here the industry appears to be profitable. The best bark (also from *C. obtusifolium* var. *Loureirii*) comes from Thanh-hoa in the north, although the amount produced is small; the second best bark comes from Nghê-An; and the third from the southern provinces of Quang-Nam (the chief producer) and Ngai. Most of the bark is obtained from wild trees. Trees 10 to 12 years old, averaging 8 to 12 in in diameter, are preferred and are generally felled before barking. The system of barking adopted consists in making 3 longitudinal incisions through the whole thickness of the bark on both stem and branches followed by transverse circular cuts, so that pieces 12 to 16 in in length can be removed. The taste of Annam cassia is said to resemble that of coriander.

The Saigon cassia appears to be distinct from *C. Cassia* in the structure of the bark, but has no special name and it is suggested that it is merely a geographical variety having regard to its resemblance in certain characters. It is in any case considered superior to Chinese cassia.

Some of the cassia from Cochin-China is derived from *C. Tamala*.

DUTCH EAST INDIES — Although *C. zeylanicum* has been grown to some extent in Java, it did not prove very profitable, owing to the apparent loss of high quality of bark when transplanted to another country. A negligible quantity of bark is derived from *C. Cassia* and the rest from *C. Burmanni*. This appears to prefer a high altitude; it is found wild throughout the Malay archipelago and yields cinnamon of high value. All the bark from Padang, Macassar, Sumatra and Timor is said to be deri-

ved from these species, but some of the bark from the Eastern archipelago is attributed to *C. iners*.

In the interior of Padang, where the trees are grown on a large scale, they are barked when about 8 years old, the best qualities coming from the trunk, the next best from the thicker branches, though this lacks flavour.

Javanese cinnamon is said to rank in value between that of Ceylon and that of Tellicherry (Malaba, W. India).

*C. Sintok* (Blume) is abundant in Java and the Malay Peninsula and also probably in Sumatra, but although apparently collected and sold in Java, it is not certain that it constitutes any part of the commercial bark of Sumatra. The bark is very aromatic and thicker than Chinese cassia.

**SOUTH AMERICA.** — Brazilian cinnamon, said to be derived from introduced *C. zeylanicum* is of decidedly inferior quality. The Cayenne sassafras (Brazilian clove-bark) (*Dicypellium caryophyllatum*), which is plentiful in the Guianas and Brazil is the chief product and yields on distillation an oil strongly resembling clove-oil.

**CONCLUSIONS.** — Although without doubt the bark of the true cinnamon *C. zeylanicum* as cultivated in Ceylon is the best obtainable and the other barks here enumerated cannot well be substituted for it medicinally, even if perhaps capable of replacing it by their cheapness as spice, the leaves could most certainly be readily used as sources of oil, eugenol and vanillin. In some cases, such as Annam cassia in China, bark collected from wild trees commands an even higher price than Ceylon cinnamon, and it has been suggested that these species might be improved by cultivation and by better preparation of their bark. In addition they would doubtless prove more adaptable to change of climate and soil than *C. zeylanicum*.  
M. L. Y.

578 — **Effects of *Cucurbita Pepo* Seeds on Kidney Excretion.** — MASUROWSKY, B. (Columbia University), in *Proceedings of the National Academy of Sciences*, Vol. 8, No. 3, pp. 39-43, Easton, March 1922.

The author shows the effects on kidney excretion (discovered by him and proved by experiment) of pumpkin seeds (*Cucurbita pepo*), roasted and raw, which have a chemico-pharmacognostic value. The addition of 30 to 35 grams of these seeds to a vegetarian diet (with milk or butter) causes an average increase of 17 % in the quantity of urine excreted.

J. D.

579 — **The Utilisation of Paper Mulch in Pine Apple and Sugar Cane Cultivation in Hawaii.** — CHURCH, T. A., in *The Florida Grower*, Vol. XXV, No. 9, p. 6. Tampa (Fla), March 4, 1922.

HORTICULTURE

The experiments made by Hawaiian growers in the use of paper mulch spread over the ground for protection purposes have given most satisfactory results. The fruit grown on plots thus treated gave an increased yield of more than 3 ½ tons per acre. The plants appeared also to be in a much better condition than those on untreated land. In addition, the use of mulch reduced the expense of cultivation by two-thirds, and

served as a valuable form of protection against damage from heavy rains, soil-baking etc. It is also of interest to note that the soil under the paper was from 2 to 5° warmer at night than in exposed fields.

After the land is prepared for planting, the paper is unrolled and spread over the ground and holes are punched in the paper to make room for the seedlings. It is estimated that a group of 3 or 4 men can lay paper at a cost of less than 3 dollars per acre. The ideal paper for this work should be 300ft. long (the standard length of pineapple rows in Hawaii) 36 in. in width for double lines and should have good insulating qualities.

It is probable that one of the cheaper grades will be used for standard practice, possibly one made from bagasse, which is now burned as waste.

Paper mulch is also used extensively in sugar cane plantations in Hawaii, where the idea originated. In the new fields, the young cane shoots find no difficulty in piercing the paper which is also very effective as a preventive of weeds. In the old fields the paper is spread over the rows after the cane is cut and before the new shoots appear. The cost of labour has been reduced by more than 40 % through the adoption of this new method.

M. L. V.

580 - **The Cultivation of Blueberries (Whortleberries) (*Vaccinium* spp.) in the United States** (1). — COLVILLE, F. Y., in *United States Department of Agriculture Bulletin* No. 974, pp. 1-24, plates 29. Washington, 1921.

Experiments in *Vaccinium* cultivation have been in progress in the United States since 1906 and up to the present 16 acres have been planted with 27 000 different hybrid seedlings and certain hybrids have been selected as of value from an agricultural standpoint and are in the hands of nursery-men for commercial propagation. In addition to this, certain wild whortleberry plants have been used with success as breeding stocks. The author gives the reports of these experiments combined with other points of distinct value to the intending grower. Certain points have already been dealt with by the author in a previous article (2) but it is of interest to note that in connection with the acid soil particularly suited to *Vaccinium* cultivation, a specific acidity of 100, corresponding to a hydrogen-ion concentration of  $P_H = 5$  is the most advantageous.

As regards propagation, budding appears to be the best means of producing a large quantity of cutting wood but the easiest methods have been layering and the so-called tubering, i. e. the forcing of new shoots in such a way that their basal portions are morphologically scaly rootstocks with a strong rooting tendency. A detailed description is given of the points which should be observed in following this system. An experiment has recently been made at Whitesbog in the use of lath instead of muslin shades, which allows each cutting to receive direct sunlight. The proportion of cuttings that rooted under the lath shades has so far shown the distinct advantage of adopting this method.

(1) See R. Feb, 1915, No. 191; R. March 1916, No. 271; R. April 1916, No. 409. (Ed.)

(2) See R. April, 1921, No. 367.

Wild plants and hybrids vary very much in their response to the different methods of propagation. Cuttings of the variety *V. angustifolium* and hybrids between this wild variety and *V. corymbosum* have shown a higher yield of rooted plants, and in such cases, mound layering has been found the more satisfactory.

Amongst the cultural operations advised it is noted that in 1919-20 BECKWITH of the New Jersey Agricultural Experiment Station conducted a series of fertiliser experiments and the most successful results were obtained with the following nuxture nitrate of soda 170 lb + dried blood 230 lb + steamed bone 340 lb + phosphate rock 340 lb + potash 170 lb. The yield was more than three times greater than from unfertilised bushes on the same sandy soil. The application of this fertiliser is recommended at the rate of 600 lb per acre.

*V. corymbosum* does not require yearly pruning but it has been found advisable to remove all the stems of *V. angustifolium* more than one year old, which have not made vigorous growth during the season, good results in fruit yield being thus obtained. A systematic burning once in 3 years of areas devoted to the cultivation of this variety has led to vigorous development in the form of stems bearing large leaves and an abundance of fruit buds which give excellent yields, the second summer after burning.

The industrial advantages attached to this crop are evident after observation of the yield and returns recorded at Whitebog (N.J.) viz an average yield of 96 bus. per acre sold at rather more than \$10 per bus. the receipts being at the rate of \$966 per acre. This record refers to plants 7 years old. The following year (1920) this planting yielded at the rate of 117 bus. i.e. \$1280 per acre. After a plantation has been once established its maintenance is relatively inexpensive.

M. L. Y.

551 - **Cultivation of the Loganberry in France.** — CROCHETIER, J. (Director of the Agronomic Station of the Somme) in *Journal de culture et ruralité* 11 Year Vol. XX No. pp. 158-159. Paris. March 4, 1921.

The author draws attention to the advantage of introducing into France the culture of this hybrid from the raspberry and blackberry which is already extensively grown in the United States and Canada and briefly mentions the multifarious uses of this fine fruit which grows in clusters of 5 or 6 and is about three times as large as the blackberry. The loganberry is already found in some gardens in Amiens and the author has grown it successfully since 1914 in the experimental grounds at Rivery. It is very prolific and hardy and easily withstood the severe cold of 1916-1917. It requires very little attention.

F. D.

582 **Gramineae and other Lawn Plants Resistant to Drought.** — PURRILL, W. B. in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 1, pp. 10-13. London. 1922.

Observations made during August 1921 in the Royal Botanic Gardens, Kew.

Although the drying up of grasses was doubtless to be attributed

directly to lack of water in the soil and sub-soil, it has been found possible to identify certain secondary factors showing variation in the drought resistant capacity of certain species of gramineae and other lawn plants which should be useful for future guidance.

The perennial rye-grass (*Lolium perenne*) was evidently the most drought resistant grass. This can hardly be attributed to the morphological structure of the leaves and shoots, but possibly to the fact that it is deep rooted, tufted and possesses a somewhat extensive subterranean system. The importance of this fact was confirmed by the survival of the couch-grass *Agropyron repens* with its widely-spread underground stolons.

A few of the coarser grasses survived in places, e. g. *Dactylis glomerata*, *Holcus mollis* and *H. lanatus*, which was probably due to the hairy covering on stems and leaves.

The early flowering species of the perennial grasses appeared least able to withstand drought e. g. *Poa pratensis*, *Alopecurus pratensis*, *Phleum pratense*, *Arrhenatherum avenaceum*, *Avena pubescens*, *Cynosurus cristatus*, and *Bromus* spp. etc. died off readily. The previously mentioned *L. perenne* and *A. repens* are later flowering species. The *Festuca* spp. also appeared incapable of resisting drought.

Apart from the resistant Gramineae it was noticed that the greenest turf constituents were members of the Compositae. *Achillea Millefolium* continued green throughout the drought, as also *Anthemis nobilis*, while others which remained fresh were *Hypochaeris radicata*, *Hieracium pilosella*, *Crepis virens*, *Plantago lanceolata*, all with deeply penetrating tap-roots or well-developed stolons. Green low lying plants such as *Medicago lupulina*, *Trifolium repens* and *T. pratense* were very prominent as resistant species.

Among the weeds which were observed to remain green and flourishing and which had gained entrance owing to the dying out of unresistant plants may be mentioned *Nasturtium sylvestre*, *Coronopus didyma*, *Solanum nigrum*, *Polygonum aviculare*, *P. persicaria*, and *Chenopodium album*.

M. L. Y.

583 - Flower Bulbs on the French Riviera. — TSCHAEN, E., in *Journal d'agriculture pratique*, vol. 1, No. 5, pp. 96-97. Paris, Feb. 4, 1922.

The culture of flower bulbs on the Riviera, from Bandol to Lavandou, is carried on for two purposes: the production of bulbs ready for flowering and cut flowers. Millions of these bulbs are sent yearly to America, Holland and England, while from January onwards the cut flowers are sent to Paris, and the English and Belgian markets. The centres of the trade are at Ollioules and Hyères.

Formerly the Roman hyacinth predominated; but the eelworm so interfered with this culture as to cause its disappearance from the market. At present narcissi hold the first place. Owing to the high prices realised in recent years, this culture is of growing importance.

The period during which the flowers are gathered begins in December

for the narcissi and a little later for the hyacinths and lasts through the Spring; the bulbs are gathered from the middle of June.

The varieties of narcissus most cultivated are the bouquet or Constantinople narcissus (*Narcissus Tazetta*) and the jonquil narcissus (*Narcissus Jonquilla*). Several varieties have been produced from the Constantinople narcissus: 1) the pure white narcissus (*N. Tazetta totus albus*) 2) the pure white large flower narcissus (*N. Tazetta totus albus grandiflorus*) 3) the Golden Sun narcissus (*N. Tazetta auretta*) 4) the Grand Monarch narcissus (*N. Tazetta concolor*). The jonquil narcissus (*N. Jonquilla*) is also utilised for the perfumery trade. Two species of hyacinth are cultivated: the Roman hyacinth and the Dutch hyacinth, including a very large number of varieties.

It is stated that the profits arising from the culture of the hyacinth range from 15 000 to 50 000 fcs. the hectare. In the 1921 Exhibition the prices for narcissus bulbs ranged from 120 to 160 fcs. and those for hyacinth bulbs from 450 to 480 fcs. per thousand. From 200 000 to 300 000 bulbs can be reckoned to the hectare. Then the cut flowers should be taken into account. Bunches of from 10 to 12 flowers form bouquets which are sold by the 100 at prices ranging from 8-10 fcs. up to as much as 90-100 fcs. These prices are the same for hyacinths. The latter are likewise sold to the perfumery trade, at prices of from 2 to 3 fcs. per kg.

The bulbs intended for exportation, after having been inspected by the Phytopathological Department, are packed in cases containing 80-100 kg. and generally sent to Marseilles for consignment. F. D.

584 — **The Cultivation of the Date Palm in Mesopotamia and Investigations as to the Yield.** — Dowson, V H. W. (Agricultural Directorate) in *Agricultural Directorate, Ministry of Interior, Mesopotamia, Memoir III*, Pt. I, pp. 1-75, pl 54, 1 map. pt. II, pp. 1-23, tables 15, diagr. 4, maps 2, bibliography of 25 works, Cambridge, 1921

FRUIT  
GROWING

**DISTRIBUTION.** — The most important area of date cultivation in Mesopotamia, and probably, in the world, is that of Shat-Al'Arab where about 138 000 acres of date palms are to be found, and it is estimated that the total number of palms amounts to from 15 to 16 millions (average of 140 per acre). The second largest date cultivation centre lies around Baghdad, and apart from these nearly all the towns are surrounded by date groves of comparatively large size.

**CULTIVATION.** — **Soil.** — The best dates are produced near Badra and Mendali close to the limestone hills, but the palm is found to grow well on a variety of soils, viz. rocky loam, river silt and desert sand and is more tolerant of salt than any other cultivated crop in the country; water logged soils and excessively dry soils are however considered unfavourable.

**Tillage.** — The best methods are employed in the Shat Al'Arab districts. Here the land is dug every fourth year to a depth of about 4 ft. It is estimated that three men will dig 1 acre in 1 to 2 months (working only until midday), and they are paid an average wage of 30-36 rupees per week per 3 men. The system adopted is to dig the 4 ft. in 2

pits and the first is put below the second, old roots are removed and manure is added equivalent to about 3 tons per acre though liable to variation. Apart from the gardens in this district and near Baghdad, very little manure is used. A quarter of each well-cultivated Basra garden is dug deeply every year and the remaining three-quarters is only given a shallow digging. Where these methods are not employed the yield of dates is low and of inferior quality.

*Subsidiary catch crops.* — A list is given of the subsidiary crops to be found in date gardens, but it is stated that in the most profitable gardens, the space between the palms only permits the cultivation of citrus and other fruit trees, and no shadeless patches remain for vegetable and other low growing crops, and this is only possible in newly made gardens. In some cases there is a great demand for palm gardens as grazing areas, where catch crops are not planted and the ground is allowed to run wild.

*Irrigation.* — Although the date palm can apparently live for a long time without irrigation, has a serious effect on the yield, however, the diversity of water types seems to have no influence on development (the water is clear, salty, sulphurous, etc.). Water is provided by tidal inundation, by gravitation flow or by lift. The methods employed vary with the district, and descriptions applicable to each are given. As regards the lifting process, where flow water is not available, apart from the primitive water Hoist (*dahlia*) and the Animal Power Water Hoist (*charad*) and the big water wheels, the most improved appliance is the "noria" or Persian wheel (*naoor*) which consists of an endless chain carried by a wheel which is made to revolve by power provided by animal draft. As the chain revolves the buckets tip under the surface of the water in the well over which the "noria" is set, filled up and are carried upwards over the supporting or revolving wheel where they empty their contents into a trough fixed above the axis of the wheel. A similar machine is also in use with some slight variation as described by the author.

The most effective irrigating machine is stated to be the centrifugal pump worked by an oil engine. These have worked with success at Baghdad and Amara. An illustration is given of GWYNNE'S Invincible Centrifugal pump, 6 inch. suction, 8 inch delivery, used at Amara for irrigating a 15 acre date and vegetable garden.

*Pruning.* — Each year the dead and dying outer fronds are cut off about 1 ft. from the trunk, and when the palm is about 14 years old, the woody and expanded bases are cut away close to the trunk which kills off any existing sucker buds. When the dates are about  $\frac{1}{2}$  inch long, the erect spadices are pulled down below the fronds in order to facilitate harvesting, and at the same time the spines are stripped off the fronds.

*Fertilisation.* — This takes place in March and April, and necessitates the placing of male inflorescences amongst the female, as the date palm is dioecious and wind pollination cannot be relied upon.

*Ripening and harvesting.* — A description is given of the appearance



of the fruit at the four distinct stages, and of the local methods of gathering the fruits when ready and the division of the harvest between the garden owner and the "fellah" (agricultural labourer).

*Diseases.* — A saprophytic fungus has been found attacking the palms and fresh dates and also the following insects: *Tetranychus* sp., *Parlatoria Blanchardi* (does very little damage), *Oryctes* sp., a longicorn beetle (possibly the larvae of *Prietyrranus mordax*) and tineid moths (*Gelechiidae* sp.). The stored fruit is subject to attack from various small moths and beetles, amongst them *Ephesia*.

*Propagation.* — Although the date palm may be grown either from a seed or sucker, the seedling does not breed true and the dates are of inferior quality to the parent, and the sex may be different. Consequently, commercially the sucker method is employed, the offshoots are removed when about 4 years old and the young shoot is planted between the old palms. It is commonly stated by owners that the maximum yield from each palm is obtained when palms are planted at the corners of squares whose sides are about 8 yds. long, i. e. about 80 palms to the acre. The author considers that sufficient data are not available to state definitely what number of palms of each variety to the unit area will produce the maximum yield; but it would seem that the average is about 100. This question is a matter quite apart from the problem of obtaining the maximum profit from any *area*, where it is considered advisable also to grow other subsidiary crops.

*Packing and marketing.* — The 6 different types of packing receptacles are given, the chief being wooden boxes containing 68 lb. net, and the author proceeds to give data relative to the general production, exports etc., according to the Customs Report etc.

*Uses of the palm and its products.* — Apart from the well known use of the actual fruit and fibre it is interesting to note the various uses made of the trunk, heart of the crown, fronds, frond midribs, frond bases, leaflets and leaf stalks.

*YIELDS.* — The primary object of the inquiry which the author undertook during the autumn of 1919 on the Shat Al'Arab was to provide reliable statistics of the average yield of dates per unit area with a view to the discovery of a broad basis for just taxation. The individual yields of dates from 930 palms belonging to 19 varieties and from 36 different gardens widely scattered over the Basra county have been recorded and combined with an inquiry as to the average number of each variety of date palm and of fruit tree per unit area in 84 areas of equal size in 39 gardens, also widely scattered over the same county.

The accompanying Tables show the data obtained and the relative yield on each are examined. The average yield of "tamar" dates (third and last stage of ripening) per acre in the date lands in 1919 appear to have been 4920 lb.; the leading variety is Istaaamran (2183 lb.) followed by Halawi (1584 lb.) and Zahidi (378 lb.) etc. The last mentioned is, however, the least choice date and Istaaamran next; the Khadhrawi, Halawi and Dairi are good dessert dates but less common.

The prices fluctuate rapidly and within wide limits. A very rough approximation has been made and taking these figures as a basis, the gross value per acre appears to be about 272 Rs. The value per acre over the whole district of the "khalal" and "racab" dates (second stages of development) sold is estimated roughly at 20 Rs. M. L. Y

# VINE GROWING

585 - Factors influencing the Increase in Grape Yield in Western India. — PRAYAG S. H., in *The Agricultural Journal of India*, Vol. XVII, Pt. I, pp. 41-50, plates 2. Calcutta, Jan. 1922.

Report as to the success obtained in adopting certain improved methods of vine training, pollination, manuring etc. with a view to increasing the commercial value of local grape varieties in western India.

*Methods of training.* — Of the several types of training employed, the system giving the best yield has been the "umbrella" type and this has been found distinctly superior to the single stake system previously employed. The overhead system has also been a definite success and has given three times as much yield as the single stake. Four canes of each plant are extended in different directions until they meet the canes of the next plant. Short spurs are formed in this way, leaving more room for the development of flowers and fruit.

The author carried out an experiment keeping the long canes formed during the rainy season and pruning them, after leaving 10 or 12 buds instead of adopting the short-and-renewal spur method of pruning after 2 or 3 buds. The yields per plant obtained, by keeping the long canes, compared with the latter system were about four times greater. Further experiments are considered necessary, however, before the long-cane system can be recommended unreservedly.

The KNIFFIN or drooping system, much practised in America, has shown an advantage over the local single stake system only on very exceptional occasions.

*Pollination* — A special study was made by the author at the Ganesh-kind Botanical Garden, Kirkee, of the two classes of grape clusters in existence, viz. loosely set and closely set fruits. On examination in the laboratory of the pollen grains it was, however, considered that the flowers were not self-sterile. Other methods of improvement of yield such as girdling or ringing and coiling had therefore to be adopted.

*Manures.* — The most efficacious of the manures tried proved to be 1) a combination of fish manure and sulphate of potash; 2) safflower cake + bonemeal; the latter gave the higher yield, but when applied after the April pruning instead of in the autumn, in order to influence the production of strong bearing wood for the next season the fish manure combination proved preferable.

M. L. Y.

586 - Grape Preservation in Almería: Cultivation and Preservation Experiments made in Italy. — SANNINO, F. A., in *Rivista di Ampelografia*, Vol. III, No. 2, pp. 22-23. Alba, Feb. 28, 1922.

Hitherto it has always been considered that the facility of preserving Almería or Hoanez grapes, is due to the fleshy character of the pulp,

and to the usually resistant skin, but it has recently been proved that it is due rather to the extremely dry climate in the *Almérie* region.

Irrigation takes place several times in this area, and in September, at the vintage, the weather is always fine and dry; conditions unquestionably favourable to grape preservation.

In 1896, an exporter of Messina (a town situated in the rainiest district of southern Italy) obtained most unsatisfactory results, by keeping the table grapes in wood shavings and in sawdust, according to the custom of *Almérie*. New experiments were made in 1920, a very dry year, with the cultivated *Almérie* grape at the Royal American Vine Nursery at Palermo. Large yields were obtained and the grapes kept well; in 1921, a rainy season, the crop was poor.

Drought conditions are also useful at the flowering period, which is very short. As this vine possesses a female inflorescence, artificial cross-pollination is necessitated such as PAULSEN (Director of the Royal Nurseries, Palermo) made with the pollen of the male inflorescences of *Aramon Rupestris Ganzin*.

The *Almérie* grape after transport to Palermo and to Spadafora (near Milazzo), appears to be easily damaged by fungous diseases: oidium, mildew, and grape mould. The quality of the grape when left on the vine, and the quality when cut present two separate characteristics: the *Almérie* grape will keep for a long time after cutting if the grapes are placed in layers on sawdust inside the receptacle, but they will not keep at all, if left hanging on the vine, owing to their liability to rot. However the "*Marsigliana*", and "*Lacrima di Maria*" of Termini Imerese and the "*Catelanese*" of Somma Vesuviana are exceptionally good varieties, even for leaving uncut.

The trials made with the *Almérie* grape at Palermo and at Spadafora confirm the conclusions arrived at by GOBBATO and BRIGANTI namely, that this particular grape is adapted solely to warm and dry districts.

F. D.

587 - **Forestry Journals, Forestry, Timber-Trade and Wood-Working Industries Journals and Serials.** — IMMINK, D. H., in *Tectona*, Part. XV, No. 2, pp. 105-122. Buitenzorg, Febr. 1922.

FORESTRY

A survey of the periodical and serial literature on forestry is attempted. Such a list, covering the German literature as well as that of other countries has, as far as the writer's knowledge goes, never been published before, while, on account of the rapid expansion of late years, it has become increasingly difficult to obtain a comprehensive view of this field. The principal causes of this expansion of the literature are the extraordinary progress of late years in forest-exploitation and forest-technology as well as the awakened interest in forestry in America and tropical countries and in tropical timbers generally. The list comprises the "Journals", and under the heading "Serials", the publications of forest services, universities, associations, clubs etc. on the scientific, technical and economic sides of forestry and connected industries, e. g.: Communications

of forest experiment stations, Yearbooks, Bulletins, Circulars, Leaflets, etc. Purely administrative progress-reports have been omitted.

TABLE I. — *Numbers of titles arranged according to countries.*

Countries	Journals	Serials	Total	Countries	Journals	Serials	Total
				<i>Carried forward . . .</i>	161	109	270
America, U. S. A . . . . .	50	42	92	Norway . . . . .	2	3	5
Germany . . . . .	33	21	54	Denmark . . . . .	3	1	4
France with Colonies . . . . .	12	5	17	Philippines . . . . .	2	2	4
Austria . . . . .	10	5	15	Spain . . . . .	3	1	4
England . . . . .	8	5	13	Mexico . . . . .	3	—	3
Sweden . . . . .	7	4	11	Argentina . . . . .	2	—	2
Canada . . . . .	6	3	9	Hawaii . . . . .	1	1	2
Czecho-Slovakia . . . . .	6	2	8	Japan . . . . .	—	2	2
Switzerland . . . . .	6	2	8	Belgium . . . . .	1	—	1
Australia . . . . .	3	4	7	British N. Borneo. . . . .	—	1	1
Netherlands and Colonies . . . . .	4	3	7	Ceylon . . . . .	1	—	1
British-India . . . . .	3	3	6	Chili . . . . .	—	1	1
Finland . . . . .	3	3	6	Federated Malay States . . . . .	—	1	1
Italy . . . . .	3	3	6	Portugal . . . . .	—	1	1
Russia . . . . .	3	3	6	Turkey . . . . .	—	1	1
Hungary . . . . .	4	1	5	Union of South Africa . . . . .	—	1	1
<i>Total . . .</i>	161	109	270	<i>Total . . .</i>	179	125	304

TABLE II. — *Numbers of titles arranged according to languages.*

Languages	Journals	Serials	Total	Languages	Journals	Serials	Total
				<i>Carried forward . . .</i>	164	115	279
English . . . . .	74	65	139	Hungarian . . . . .	4	1	5
German . . . . .	53	30	83	Norwegian . . . . .	2	3	5
French . . . . .	15	8	23	Danish . . . . .	3	1	4
Swedish . . . . .	7	4	11	Finnish . . . . .	3	1	4
Spanish . . . . .	8	2	10	Russian . . . . .	3	1	4
Dutch . . . . .	4	3	7	Latin . . . . .	—	2	2
Italian . . . . .	3	3	6	Portuguese . . . . .	—	1	1
	164	115	279	<i>Total . . .</i>	179	125	304

As attempt is made to give, as far as possible, the following particulars about each publication Complete title editorial address, whether monthly, weekly, etc., subscription price, date when founded and number of current volume, number of pages in each publication, whether the publication is still being issued, has been superseded by another, undergone a change in name, or been discontinued

Tables I and II give the number of titles surveyed arranged according to countries and to languages

G A B

**588 - Forestry in the Straits Settlements.** — *Colonial Reports Annual No 111 Straits Settlements, Report for 1920* 35 pp London 1921

The total area of the forests under control is 42 964 hectares that is to say, 11 %, of the total area of the Straits Settlements The receipts and expenditure for 1920 were respectively 57 268 and 42 849 dollars (the dollar being equivalent to 2 shillings and 4 pence at par) as against 65 754 and 34 064 dollars in 1919 the total excess of receipts over expenditure was therefore 14 419 dollars Owing to the high prices realized for mangrove tree wood there was an increase in the receipts at Singapore but in all the other settlements a decrease the receipts having been exceptionally high in 1919 11 001 tons of wood for working were produced and 27 797 tons of firewood

In the forests under control at Sungai Ached (Wellesley Province) 100,000 mangrove trees were planted and 110 dollars for seed was the only expense

An inspection of the areas planted with "bakan" in preceding years in the forests under control in Tanjong Burong showed the success of re-afforestation If the cost of this work can be kept at a reasonably low figure it will very probably be profitable

G A B

**589 - Experiments in the Preservation of Acorns and Beech-Mast in Denmark.**

JOHANSEN, W., in *Det Forstlige Forsøgsvæsen i Danmark* vol 5 5th part pp 3-31 Copenhagen 1921

The following are the results of experiments on the preservation of acorns and beech-mast begun in 1903 and on acorn seeding begun in 1915

To preserve the germinating power of the acorns a low temperature is needed What degree of frost they will resist has not been tested but they keep well at 1° and 2° C Another necessary condition is access to the air, if deprived of air the germinating power is lost in about a year even at the low temperatures above mentioned The use of a solution of sublimate as an antiseptic is an advantage, a solution of sulphate of copper could probably also be employed, treatment with solutions of formaldehyde is not apparently of any practical use It has been possible to preserve the life of the acorns for three years the germinating power naturally decreasing gradually However, numerous vigorous plants were obtained from the seeds which survived The keeping of the seed seems to result in the survival of the fittest

Beech-mast is easily empoisoned by the use of fungicides but on the other hand if kept in a cold place can be preserved in a sufficiently healthy state for a winter or two.

After a close sowing there is a rather close correlation between the size reached by oak-seed in the first year and in the tenth, but their reciprocity is far from being invariable.

G. A. B.

## LIVE STOCK AND BREEDING.

### HYGIENE

590 - **Plants Poisonous to Live-Stock.** — I. TALBOT, P. R., and HOOPER, J. C., Weeds Poisonous to Live Stock, in *Province of Alberta, Department of Agriculture, Provincial Schools of Agriculture, Bulletin No. 1*, pp. 401, figs. 15 + 4 coloured plates separate from text. Edmonton, 1919. — II. FLEMING, C. F., and PETERSON, N. F., The Narrow-leaved Milkweed (*Asclepias mexicana*), and the Broad-leaved or Showy Milkweed (*A. speciosa*), Plants poisonous to Live Stock in Nevada, in *The University of Nevada, Agricultural Experiment Station Bulletin No. 99*, pp. 32, figs. 10 Carson City, Nevada, December 1920. — III Two Vines reputed poisonous to Stock, in *Queensland Agricultural Journal*, Vol. XVII, No. 9, p. 36. Brisbane, January 1922.

I. — **PLANTS POISONOUS TO LIVE-STOCK IN THE PROVINCE OF ALBERTA, CANADA.** — It is estimated that more live-stock is annually lost in the Province of Alberta from eating poisonous plants than from any other cause. The Bulletin analysed gives the necessary information for the identification of the most dangerous wild plants growing in the Province, the best methods of preventing stock from eating these plants, the symptoms produced by their consumption, and the treatment of toxic disturbances caused by them.

The following is a list of the plants described: tall larkspur (*Delphinium glaucum* S. Wats = *D. Brownii* Rydb); low larkspur (*D. bicolor* Nutt. = *D. Menziesii* D. C. and *D. azureum* Michx.); death camas (*Zigdenus venenosus*); water hemlock (*Cicuta maculata*); white locoweed (*Oxytropis Lambertii*); woolly loco-weed (*Astragalus mollissimus*); showy loco-weed (*A. splendens*).

As preventive measures, it is advisable to: extirpate the poisonous species; fence in infested land, so as to keep out animals; give salt and good drinking-water to the stock; keep animals away from infested districts during the dangerous season and feed them so that they are not driven by hunger to eat poisonous plants (1).

II. — **TWO PLANTS POISONOUS TO CATTLE IN NEVADA.** — These are the narrow-leaved milk-weed (*Asclepias mexicana*), and the broad-leaved milk-weed (*A. speciosa*). The authors describe these plants, their composition and habitat as well as the toxic symptoms produced by them etc.

III. — **TWO PLANTS REGARDED AS POISONOUS TO CATTLE IN QUEENSLAND.** — These are two Asclepiadeae: *Marsdenia rostrata* and *Secamone elliptica*.

F. D.

(1) See H. C. LONG, *Plants Poisonous to Live Stock*, Cambridge University Press, 1917. (Ed.)

- 591 - **Is the Sorrel Dock (*Rumex Acetosa*) Poisonous to Cattle?** — CRAIG, J. F., and KEHOE, D. (Royal Veterinary College of Ireland), in *Department of Agriculture and Technical Instruction for Ireland*, Vol. XXI, No. 3, pp. 314-317. Dublin, 1921.

The sheep-sorrel (*Rumex Acetosella*), appears to be poisonous to the horse (CORNEVIN), and sheep (MULLER) on account of the potassium oxalate it contains. The authors wished to ascertain whether a nearly-related species, the sorrel dock (*Rumex Acetosa*), is injurious to cattle as is believed by many breeders. With this object, they carried out a series of feeding experiments during the spring and summer of 1920. The results obtained led to the following conclusion: although grazing cattle manifest a certain aversion to *R. Acetosa*, it does not produce any ill-effect of importance. It thus seems that this plant does not contain sufficient oxalates to be injurious to cattle. F. D.

- 592 - **Observations on the Treatment of Puerperal Infection in Domestic Animals by Treatment with Iodide of Ioduretted Potassium.** — NADSEN, M. I., in *Berliner Tierärztliche Wochenschrift* year XXXVIII No. 7, pp. 75-76. Berlin, February 1922.

The author had observed for some years that when the uterus of mares, cows, and sows suffering from uterine inflammation or puerperal infection was washed with a dilute solution of ioduretted potassium this solution rapidly lost its colour in some cases when it came in contact with the mucous membrane, whereas in others this effect did not occur or only to a limited extent. According to experiments made by the author this loss of colour is due to the iodine combining with definite substances present in the uterine solution and forming a colourless compound.

It is not at present possible to decide whether these substances are bacteria, or the products of their metabolism, but it is certain that they exercise a pathogenetic effect and that they are rendered innocuous by the formation of a colourless compound. This is shown by the fact that treatment with the iodo-ioduretted solution has a very favourable effect upon the course of the disease.

The decoloration and the therapeutic action of the resulting ioduretted solution are not always produced because uterine inflammation in domestic animals may be caused by a number of different species of bacteria (*Bacterium coli*, *Staphylococcus pyogenes albus* and *vitreus*, *Streptococcus pyogenes* etc.). However the simplicity of this treatment makes it worth knowing and practising by stock-breeders. F. F.

- 593 - **Notes on Contagious Abortion in Female Asses and Mares.** — BRANFORD R., and DOYLE, F. M. in *Agricultural Research Institute, Pusa Bulletin* No. 11, pp. 114, 5 pl. Calcutta, 1921.

Since 1911, the authors have observed at the Hisar Stock-breeding Station several cases of contagious abortion, a disease hitherto unknown in the district.

The signs of infection are not apparent, unless the disease develops when gestation is already far advanced and it is not easy to recognise complete abortion in mares. When this occurs the membranes and fluids of the foetus have a normal appearance, if the gestation period is nearly

complete, the young foal may be alive at the moment of birth, but generally dies a few days later.

In 1920, the authors succeeded in obtaining and isolating a pure culture of a bacillus resembling both morphologically and biologically the one described by GOOD and CORBLIT (1). The bacillus was obtained by inoculating tubes of agar with blood taken from the heart and liver of a foetus.

It occurred in the form of a short thick rod with rounded ends, and was Gram negative. A bacillus with the same characters was isolated from the stomach, liver, heart and the allantoic and amniotic fluids of the aborted foetus of a female ass.

The authors believe that the unknown pathogenetic agent finds its way into the body through the mouth; they consider that the incubation period lasts 6 weeks, which is contrary to the general opinion which limits it to a time varying from 10 days to 3 weeks.

Prophylactic measures (destruction of the foetus, isolation and disinfection of the infected animal) are of little use owing to the absence of distinct symptoms of abortion and the difficulty of discovering the diseased foetus, which almost immediately falls a prey to vultures.

Immunity, even allowing that this is conferred by an attack of the disease, does not last.

E. F.

**594 - Horse Pest.** THILGER, A. in *Department of Agriculture of the Union of South Africa Science Bulletin* No. 13, pp. 1-3, JICTORIA 1911.

THILGER's paper on this subject deserves mention as it gives an excellent synthetic review of all that is known regarding the natural and medical history of horse pest and has in appendix with a bibliography of 32 works dealing with the researches carried out on horse pest by the Bureau of Veterinary Research of the Government of the South African Union.

E. F.

**595 - New Endoscopic Methods for the Examination of the Horse.** SPIRZ, G. *Archivos da Escola Superior de Agricultura e Medicina Veterinaria* Vol. IV No. 2 pp. 77-83, pl. XVIII XX, Niteroi (Brazil) December 1911.

In order to diagnose certain diseases of the horse, it is necessary to carry out laryngoscopic and pharyngoscopic examinations, but the apparatus for this purpose has been very rarely used, as it has many serious defects. These difficulties can be avoided by adopting the technique devised by SPIRZ, by this means laryngoscopy or pharyngoscopy, become easy and can be carried out by anyone.

The following instruments are necessary: 1) a metal, so-called endoscopic tube, this is cylindrical and is 50 to 55 cm. long and  $1\frac{1}{2}$  to 2 cm. broad; 2) an *illuminating apparatus* consisting of an incandescent lamp of 5-6 volts fixed to the end of a rigid conducting rod a little shorter than the endoscopic tube. The rod can be easily introduced into and adapted to the interior of the tube and is provided with the necessary arrangements.

(1) *Journal of Infective Diseases*, July 1913 (Author's note).



for putting it into connection with a supply of electricity ; 3) a *supply of electricity*

An oral examination of the pharynx, or larynx must be carried out on the horse when it is lying on its back, or on one side, the head and neck being so arranged that the angle formed by the neck with the buccal cavity is as nearly as possible 180°, or in other words, the head and neck must be almost in a straight line. The arrangement of the head and neck is of great importance for the success of the examination, as if carried out as advised, the endoscopic tube may be easily introduced, and the operation can be quickly performed.

SPITZ'S method affords a more extended and clearer field of observation than is obtained with other methods. The author has adopted it since 1912 in a fairly large number of laryngoscopic and pharyngoscopic investigations. The results obtained were excellent and not attended with the slightest trouble

If an endoscopic tube of slightly less diameter is used, the same technique allows of pharyngoscopy through the nose, and hence of the examination of the orifice of the Eustachian tube

E. F.

596 - **The Simultaneous Method of Inoculation with Anti-Rinderpest Cattle-plague Serum.** — POOL, W. A., in *Agricultural Research Institute, Pusa, Bulletin* No. 120, pp. 1-7, with 2 Appendices, Calcutta, 1921

This article contains brief instructions for inoculating cattle with anti-rinderpest serum by means of a new method that confers lasting immunity and is called simultaneous, because while a sub-cutaneous injection of it is made beneath one shoulder, the other shoulder is injected with blood taken at the time the fever runs highest, from an animal suffering from rinderpest. On the seventh, or eighth, day individuals that have not reacted to the first injection are given a second inoculation of virulent blood (5 cc), without any further injection of serum.

The author gives a short account in the following paragraphs of : the means of obtaining the serum, the cases where inoculation should not be practised, the measures to be taken to prevent the introduction of piroplasms together with the virulent blood, and the contamination of healthy animals by those that have not yet been immunised

E. F.

597 - **On an Acute and Epidemic Form of Parenchymatous Hepatic Inflammation in Sheep.** — KNUTH, P. and STEPHAN, J., in *Berliner Tierärztliche Wochenschrift*, year XXXVIII, No. 7, pp. 73-74, Berlin, February 16, 1922.

One of the authors of this article, KNUTH, has observed numerous sheep affected a disease that quickly causes the death of 25 % of the flock. The clinical symptoms of the disease are as follows: yellow colour of the exposed mucous membranes; difficult respiration; a flow from the nostrils of whitish mucus mixed with blood; soft pitch-coloured excrement mixed first with mucus, and later with blood; very weak pulse; corneal reflex entirely absent, pupil dilated and not reacting to direct light, rectal temperature 41° C.

The examination of the internal organs belonging to three animals revealed the following lesions: slight swelling of the mucous membrane of the stomach and small intestine, the spleen swollen, dark brown, hardened, with reticulation clearly recognisable in sections, the liver very swollen, brittle, dried up, brownish-yellow in colour and the lobules no longer distinctly separate, the gall-bladder full and distended, the cardiac muscle dark-red, rigid and dry.

A microscopic investigation of thin slices of the liver revealed the typical syndrome of acute parenchymatous fatty degeneration of the liver cells. Since the negative results of the microscopic examination of the blood and organs excludes all possibility of bacterial infection, the authors diagnose the disease as a *fatty parenchymatous degeneration of the hepatic cells that manifests itself in an epidemic form*. They believe it to be due to plants eaten by the cattle while grazing (1).

This work is important a) as being a contribution to our knowledge of a hitherto little known disease described by several authors under the name of *epidemic parenchymatous hepatitis of sheep* b) because the syndrome of symptoms described can easily be mistaken for those induced by phosphorus or arsenic poisoning or the toxic effects of some leguminosae.

G. F.

#### FEEDS AND FEEDING

598 - The Use of Calcium Salts in the Feeding of Animals. — Ohio Agricultural Experiment Station, Bulletin 31 pp. 1 fig. Wooster Ohio 1917

The bulletin analysed contains the following 6 papers:

I — FORBES F. B. HARRISON J. O. MORGAN, L. G. and SCHUTZ J. A. *The metabolism of calcium salts in a growing pig* — Experiments to determine the metabolism of the mineral constituents of the ration were carried out in November-December 1917 with 5 young castrated boars of the Poland China breed. There were 3 experimental periods of 10 days each separated by intervals of 7 days. To a basal ration consisting of maize flour + linseed cake + wheat sharps (7:1:1) with salt in the proportion of 1:450 were added various mineral supplements which are given together with the chief results obtained from them in Table I.

It was found that the characteristics of the metabolism of swine fed almost exclusively on the grain of cereals were as follows: loss of calcium, abnormal gains in magnesium and phosphorus, very acid urine containing much ammonia. An excess of potassium was present in the basal ration, whereas sodium and chlorine except for the small quantities supplied in the form of kitchen salt were lacking.

The insufficient assimilation of calcium is an important factor in determining the gains in phosphorus and to a lesser degree, in magnesium. The increasing ingestion of calcium in the form of precipitated carbonate or powdered limestone, causes a marked increase in the calcium, magnesium and phosphorus gains.

(1) The authors have carried out some experiments in order to identify these plants; they will give the results in a subsequent paper. (Ld.)

The addition of 1 part of salt to 450 parts of grain, the basal ration, causes a gain in both sodium and chlorine. The gains in sodium and potassium were as a rule, almost equal. The need of sodium was more quickly satisfied than that of chlorine. All the mineral additions, especially the precipitated bone-meal, served to increase the chlorine gains as compared with the basal ration without any addition.

The magnesium content of all the rations was sufficient. When the magnesium metabolism was negative, the loss was due to the hindering effect of other factors, especially to insufficient ingestion of calcium. All the mineral additions had a favourable influence upon the magnesium gains. In some cases, the improvement of the latter were to be attributed entirely to the increase in the amount of calcium ingested.

Ground limestone, precipitated bone-meal, degelatinised bone-meal and precipitated calcium carbonate had much the same effect on the calcium gains, whereas ground mineral phosphate was clearly less effective.

The gain in phosphorus was distinctly increased by all the additions containing calcium, whether in the form of the carbonate, or the phosphate.

The solubility of the compounds seems to be the chief cause of the gains; precipitated calcium carbonate and precipitated bone-meal are the most effective, ground mineral phosphate having much less effect. Compared with the potentially acid, basal ration, the compounds containing calcium carbonate lowered the acidity and the ammonia of the urine, but precipitated bone-meal (containing bicalcic phosphate) increased them.

Mineral additions had no effect upon the digestibility of the ration.

One third of the sodium evacuated by the organism was found again in the urine and one third in the faeces. A larger proportion of potassium found its way into the urine, and still more into the faeces.

Generally, over 90 % of the chlorine passed into the urine.

The capacity possessed by the digestive apparatus of absorbing mineral foods is limited in the first place by their solubility and afterwards, amongst other factors, by the rapidity with which these substances pass from a soluble to an insoluble condition in the blood and lymph, either by means of a synthetic process, or as a result of excretion. The gains in absorbed mineral nutrient substances are governed by the requirements of nutrition, and are not increased by limiting elimination which would immediately decrease absorption.

The most effective, and certainly the most soluble mineral additions used were precipitated carbonate and precipitated bone-meal. Other compounds may be more practical, though less effective, if the pigs will eat them and can tolerate them when fed in sufficient quantities. The most urgent mineral need of growing animals, after common salt, is satisfied by calcium carbonate. When, however, the assimilation of the phosphorus, which is normally present in the ration for the building up of the skeleton, is thus assured, some form of calcium phosphate must be given.

With a certain loss of phosphorus, all the need for mineral additions can be satisfied by calcium phosphate. The phosphate is dearer than the

carbonate, but it is more easily tolerated, and if fed separately from the ration, is more acceptable to the stock.

TABLE I. — *Effect of mineral additions on the metabolism of calcium, magnesium and phosphorus.*

Mineral added	Amount ingested per kg. of live weight			Amount ingested per kg. of live weight			% assimilated of the amount ingested		
	Ca.	Mg.	P.	Ca.	Mg.	P.	Ca.	Mg.	P.
	mg.	mg.	mg.	mg.	mg.	mg.	%	%	%
<i>First Experiment.</i>									
None . . . . .	21	63	138	— 6	— 3	+ 12	— 30.4	— 4.0	+ 8.5
Ground limestone . . . . .	113	67	138	+ 56	+ 1	39	+ 49.9	+ 2.0	28.4
Ground mineral phosphate . . . . .	99	60	163	34	0	26	34.7	0.5	15.6
Purified bone meal . . . . .	76	48	129	38	1	27	50.5	1.1	20.6
Precipitated carbonate of lime . . . . .	99	52	111	57	2	36	57.8	3.1	32.2
Precipitated bone meal . . . . .	89	67	168	50	2	35	56.1	2.7	21.0
<i>Second Experiment.</i>									
Precipitated bone meal . . . . .	112	64	186	46	3	33	41.1	4.0	17.8
Precipitated bone meal + degelatinised meal (1:1) . . . . .	102	70	189	44	3	36	43.6	4.6	18.9
Precipitated bone meal + ground limestone (9:1) . . . . .	89	76	189	43	3	33	47.7	3.4	17.5
Purified bone meal . . . . .	74	61	152	38	2	28	51.0	2.9	18.4
Bone . . . . .	18	56	119	0	0	9	1.3	0.1	7.8

II. — FORBES, E. B., HALVERSON, J. O., SCHULZ, J. A. and WELLS, E. B., *Metabolism of some calcium salts in growing swine.* — A second experiment to ascertain the metabolism of the mineral constituents of the ration was carried out from August to October 1918 with 4 castrated pigs of the Poland-China breed. The chief object of the experiment was to compare the effects of the addition of mixed minerals with those of minerals introduced separately. The results connected with the metabolism of calcium, magnesium and phosphorus are given in Table I, Experiment II.

As in the preceding experiment, the metabolism of sodium, magnesium, chlorine, sulphur and nitrogen was also studied. The results were practically the same, although there was a larger proportion of potassium in the urine. The authors bring out the independent behaviour of sodium and chlorine. All additions containing calcium were useful, from 5 to 10 tenths of the calcium administered was retained by the organism; no appreciable difference existed in the capacity of assimilating the various additions.

III. — FORBES, E. B. and SCHULZ, J. A. *The effect of mineral*

*additions upon the development of swine.* — Thirty Duroc-Jersey pigs of the average weight of 62 kg. were divided into 5 lots and given experimental rations for 86 days dating from April 30, 1917. The basal ration was the same as in the two previous experiments. The mineral additions were chosen so as to supply 5 mg. of calcium per head and per day. At the end of the experiment, the animals were slaughtered and their skeletons physically and chemically examined. The pigs of the lot given precipitated calcium carbonate and those which received precipitated purified bone-meal had relatively compact, strong skeletons, whereas the bones of the pigs that had been supplied with ground mineral phosphate were only a little denser than the bones of the control animals (ration without supplementary calcium salts) and were less resistant than those of the latter, as well as containing a smaller amount of ash per unit of volume. The skeletons of the pigs given precipitated bone-meal occupied an intermediate position as regards density and resistance. The proportion between the phosphorus and calcium present in the bones of pigs was fairly high whether they had received mineral phosphate, or the basal ration. In this, the bones differed from those of the young animals killed at the beginning of the experiment in order to determine their initial composition, in which the proportion of magnesium present in the skeletons of the young pigs was relatively lower than that of the calcium.

IV. — FORBES, F. B., HUNT, C. A., SCHULZ, J. A., and WINTER, A. R. *Effect of mineral addition on the development of swine.* — The experiments described in this paper began on July 26, 1919 and lasted nearly 16 weeks. They differ from the preceding experiments in that the mineral addition instead of being mixed in a given proportion with the rest of the ration, was fed separately and *ad lib*. Further, a larger number of additional substances were given and more determinations of the physical characters of the bones were made. The pigs were hybrids with a predominance of Duroc-Jersey and Chester-White blood.

The animals were divided into 8 lots each containing 5 individuals with an initial weight of about 21 kg per pig. The basal ration consisted of maize flour, wheat sharp and linseed meal cake (3. 1.) with the addition of 1 part in 500 of kitchen salt. The mineral additions were given to 7 lots in the buckets of an automatic distributor, 5 % of sodium chloride being added each time. During the first 5 weeks, the pigs did not relish these additions to their ration, but later when they were shut up in a brick-paved sty, they ate them in large quantities. The additions given to the various lots, the amount eaten, and certain characters of the bones determined after the animals were slaughtered are summarised in Table II.

The penetrability (hardness), was determined by means of a specially constructed microdynamometer measuring the penetration of a diamond-pointed punch 5 mm. in diameter under a pressure of 9 kg. The operation was carried out upon a transverse section from the narrowest part of the diaphysis; its faces were exactly parallel, and polished by a special apparatus. Both these machines were invented by Dr. Joseph HEAD, of Philadelphia.

TABLE II. — *Effect of an unlimited supply of additional mineral substances upon the bones of swine.*

Lot	Mineral substances added	Amount ingested per head and per day gm.	Ca. present in the additional mineral supplied	Resistance coefficient		Penetrability of tibia	Ash per cc. of tibia	Composition of fat-free dry bones			
				Humerus	Tibia			Ca.	Mg.	P.	CO <sub>2</sub>
1	Ground mineral phosphate	12.1	3.72	212	151	71.1	783	59.8	1.75	31.1	7.40
2	Ground limestone	20.1	7.84	268	183	56.3	774	60.1	1.49	30.3	8.15
3	Degelatinised purified bones	41.3	12.38	273	195	44.2	826	60.3	1.39	29.9	8.43
4	Chalk	14.0	5.23	244	167	51.6	777	60.6	1.48	29.8	8.18
5	Precipitated bone-meal	21.9	5.39	249	176	52.6	803	60.8	1.49	29.8	7.94
6	Precipitated carbonate of lime	13.6	5.25	271	201	64.4	804	60.8	1.56	29.3	8.31
7	Marl	6.8	2.41	247	157	58.7	762	60.5	1.52	29.3	8.72
8	None	—	—	197	131	53.1	722	60.8	1.58	30.1	7.46

Mineral phosphate did not make the skeleton stronger as compared with the effect of the ordinary ration without any addition, whereas all the other mineral supplements produced considerable and almost identical increases in the strength of the bones.

Degelatinised purified bone-meal makes the bones damp, less fat and more acid (both as regards volume and dry fat-free material), than any other mineral addition. The calcium and carbon dioxide contents (except the hardness, exceeded those of all the other lots, but the magnesium content was the lowest of all. The bones of the control lot were relatively poor in mineral constituents other than magnesium.

The hardest bones (Lot 3 of Table III), were characterised by a larger proportion of calcium, carbon dioxide, and ash, and by the low magnesium content of the fat-free, dry bones, as well as by the smaller amount of magnesium in the total number of mineral constituents determined (calcium, magnesium, phosphorus and carbon dioxide).

The softest bones (Lot 1), were characterised by the larger amount of magnesium and phosphorus and the smaller quantity of calcium and of carbon dioxide in the total of the constituents determined.

The difference between these 2 lots bring out the relative value of ground mineral phosphate and of purified bone-meal as mineral supplements for young animals. The mineral substance of bones is a mixture of carbonates and phosphates capable of change as a result of the selection of the carbonates serving as part of the alkali reserves of the organism. The authors are of opinion that in lots 1 and 8, the low proportion between carbon dioxide and the phosphorus of the bones shows that some elimination of the calcium carbonate has taken place to compensate for the lack of

potential alkali. This causes the formation of softer bones owing to the large proportion of magnesium phosphate.

V — FORBES, F. B., *Additional foods consisting of more or less appetising mineral preparation for swine, cattle and horses* — The author has made 19 experiments with pigs and 15 with cattle. He has found that horses also readily eat precipitated bone-meal and purified degelatinised bone-meal.

In this experiments with pigs, the author observed that purified degelatinised bone-meal which under certain conditions was the most liked, could be rendered still more acceptable by the addition of a little acid.

Meat meal increased the flavour of the mineral supplement with which it was mixed. The best results are obtained with blood meal or fish meal. Coriander seeds, and molasses also increased the flavour of the added minerals but not as much as the above-mentioned meals. On the other hand anise, fenugreek, caraway, fennel, charcoal, humus and ground lucerne hay had no effect. Preparations in the form of fine powder caused disturbances.

VI — FORBES, F. B., HAINFORD, J. O. and SCHUIZ, J. A. *The effect produced upon the alkali reserves of the pig by a diet of grain and mineral supplements* — Two pigs were fed a basal ration composed of maize flour + wheat churps + linseed meal cake + kitchen salt for 33 days. This period was followed by another during which precipitated calcium carbonate was added to the ration and the experiment terminated with a further period of 23 days during which precipitated bone phosphate was added to the basal ration.

The mineral additions were given at the rate of 0.2 gm. per kg. of live weight.

The consumption of calcium carbonate which is potentially basic increased the carbon dioxide pressure of the blood plasma and decreased the ammonia content and the hydrogen ion concentration of the urine. Bone phosphate being potentially acid had just the opposite effect. It is therefore probable that the alkali reserves of the blood plasma can be greatly altered by the character of the mineral substances added to the ration. F. D.

599 — **Boiled Cotton Seeds as a Stock Feed.** GRAHAM, I. (Chief Dairy Expert), in *Queensland Agricultural Journal* Vol. XVI No. 5, p. 10. Brisbane November 1921.

The cotton-grower is often unable to render his cotton seed suitable for a concentrated stock-feed owing to the fact that he has no available means of decorticating and grinding it. For this reason the author advises a simple method of preparing cotton seed which has been practised by many stock breeders in Queensland and is within the power of all to practise. This consists in boiling the seeds for 15 to 20 minutes, taking care to keep them beneath the water in the pot. Boiling softens the integument and makes it relatively easy to press out the seed. The weight of the boiled seeds is double that of the raw. The operation should be carried

out every day. Boiled cotton seed can be fed with bulky dry or green, foods such as chopped straw, buckwheat etc. It can also be given to milch cows which eat it with avidity. F. D.

**STOCKS  
BREEDING**

600 - **Variability in Domestic Animals and the Value of Statistics in Researches connected with Stock Breeding. Part. II.** — FEIGE, E. in *Fühling's Landwirtschaftliche Zeitung*, Year LXX, Nos. 17-18, pp. 335-348, figs. 3. Stuttgart, September 1921.

The author continues his researches on the variability of domestic animals; his method and objects are the same as he has described elsewhere (1). He deals with documents compiled from data collected in the Herdbook of East Prussia published by the "Insterburger Verband". Only the four first volumes of this work (including those for the years 1912-1915), have so far been published, therefore the number of generations registered is still too small to permit of thorough statistical analysis. Another difficulty also presents itself in this connection viz., that among the animals under consideration, some cattle of other breeds have found their way, so that a noticeable amount of genealogical heterogeneity has been introduced into the material.

The cows in question are adult animals of the Black Pied East Prussian breed; in some series they number 2500. The measurements taken are: width of chest, depth of chest, width of pelvis, height at withers, height at croup, width of hips, and length of body; the fat content of the milk was also taken into account.

In this case also, the variation curves of the dimensions of the body are asymmetrical; this (although its causes may be theoretically different), here depends upon special kinds of variation proper to the material viz., upon the fact that the animals studied belong to several fundamental and not yet differentiated biological forms, or else the effect of selection is still visible. From the systematic standpoint, the Black Pied breed of North Germany appears to be a homogeneous group, but the statistic method shows by the irregularity of the frequency curves, that no genotypic unity really exists. According to the tables drawn up and reproduced by the authors, the asymmetry of the frequency curves is not always the same, and manifests itself in different ways in each of the measurements under consideration. The question is no doubt one of lines that are different according to the genotypic point of view, each line possessing its own special characters. It is also necessary to consider, within the limits of each line, the behaviour of each character and the frequency subdivision of each of its values.

This different behaviour of the various characters as regards the distribution of the frequency of each of their possible dimensions, is a problem of great importance in stock-breeding, but its solution depends upon a knowledge of the hereditary behaviour of the genetic factors correspond-

(1) The first part of this work has been summarised in R. Dec. 1921, No. 1248. See also R. July 1921, No. 739. (Ed.)



ing to the different morphological characters. It is, however, evident that it is not by prolonged selection alone that the modifications of the germ-plasm necessary for increasing the variations of the characters can be obtained, but only by means of the combination of the dominant hereditary factors, which must be analysed thoroughly and known. In conclusion, these researches have led the author also to confirm the statement that, individual characters and their variability may be learnt from the statistical analysis of the variations of forms and capacities, but that, the mechanism of character transmission can only be discovered by the application of exact methods to unilinear generations.

As regards capacity for milk production, the "Insterburger Verband" gives (for a total number of 7534 cows), the fat content of the milk, instead of the amount of the milk, because external causes can only produce very slight variations in the fat content. Here again the tables and the variation frequency-curves lead us to conclude that there is no question of genealogically equivalent lines, for the data show the behaviour of a phenotype, not of a genotype. On the other hand, a distinct separation of each line is practically impossible, because the material has not yet attained a sufficient degree of genealogical homogeneity. E. F.

601 - **The Mating of Nearly-Related Cattle.** BUCKLES, C. H., in *Hoofd's Dairyman*, Vol. LXIII, No. 5, p. 115 Port Atkinson Wisconsin February 1922.

The above is a short popular article written for cattle breeders and giving an explanation of the terms "inbreeding" and "line-breeding". The first is applied to the mating of closely related animals, for instance brother  $\times$  sister, or son  $\times$  mother, while the second signifies the union of more distantly related individuals such as (uncle  $\times$  niece, or cousin  $\times$  cousin). It should be noted that the difference is merely one of degree, so that all persons are not of accord as to the method of distinguishing the two types of mating.

Both are usually adopted in order to retain for as long as possible the characters of an especially prepotent sire. As an instance of inbreeding, the author mentions the case of a Holstein bull celebrated for transmitting milk yield capacity to its offspring. This animal was mated with its own daughters in order to retain its blood in the largest possible number of successive generations. The Jersey breed is a good instance of the results of line-breeding.

The breeders can, according to requirements, mate animals related in the first degree, or those less closely connected by blood, or they can combine the two methods. It is well-known that the chief defects produced by prolonged inbreeding are: a) a decrease in the fertility, size and resistance of the animals; b) the possibility of transmitting and accentuating defects as well as the desired characters. E. F.

602 - **Bill for the Improvement of Agricultural Live Stock in England.** — *The Ministry of Agriculture and Fisheries*, Leaflet No. 212, pp. 1-6 London, 1921.

STOCK RAISING

The British Government has included in the budget of the Ministry of Agriculture an annual sum of about £ 35 000, to be expended in making

grants to agriculturists and Agricultural Associations for the purposes of  
*a)* enabling them to use bulls, stallions and boars of good breeds ; *b)* defraying half the expenses devolving upon Dairy Farms, or individuals, whose milch cows attain records in milk yield.

Grants are made preferably to Associations, which, like individuals, have the right to the collaboration of Live Stock Officers who are nominated by the Ministry and mentioned in the bill in question.

Among the chief provisions respecting the allocation of the grants may be mentioned those relating to bulls (the others are of similar character).

*a)* Grants are made to Associations up to  $\frac{1}{4}$ , and even  $\frac{1}{3}$ , of the value of the bull ; the maximum sum being £ 20.

*b)* If the Association acquires a bull collectively, it must obtain in addition to the sum required for the purchase of the animal, sufficient capital to bring in enough income to cover all expenses connected with the said animal, including life insurance

*c)* Should the Association arrange with the owner of a bull that the services of the animal are at the disposal of its members, it incurs the following obligations, to 1) pay the owner a sum equal to the Government grant ; 2) pay a service fee of not less than two shillings and sixpence for each cow served , 3) guarantee that at least 35 cows shall be served annually , 4) allow the owner of the bull to have at least 15 of his cows served free of charge

If the Association accepts these conditions, the owner of the bull (not the Association), is legally responsible for the custody, keep and insurance of the animal.

F. F

603 - **Thirty Year's Experimental Stock Breeding in Utah.** — HARRIS, L. S., and BUTT, N. J., in *Utah Agricultural Experiment Station, Circular No 46*, 64 pp Logan, Utah, 1921

A summary is given of the most important facts discovered in the course of thirty year of experimental work performed by the Utah Agricultural College since its foundation. A catalogue of the publications of the Station (286) is given in the Appendix. The following is a short account of the stock-breeding work (1)

**CATTLE FEEDING** — The animals used in the experiments were cattle of the native breed reared in the open

*Composition of rations* — In the experiments with lucerne + mixed hay + straw + wheat + bran, the best proportions were those corresponding to the nutritive ratio of 1 : 4.81. When, however, mixed feeds are used the nutritive value of each food must be taken into account, rather than the nutritive proportions of the ration. If cattle are given all the straw they can eat + wheat + bran, there is no need to trouble about the nutritive proportions of the concentrates to be added to the ration.

*Comparison between different forage plants* — It has been found that

(1) The other work is connected with irrigation and its effects on different crops — dry-farming — soil physics — agricultural machines — rural economy — fruit growing — the parasitic insects of cultivated plants (Ed)

the respective nutritive value of lucerne hay, meadow clover hay and timothy grass hay with equal rations of grains (1) is in the proportion of 91 : 75 : 97, whereas the proportion of the amounts consumed daily is as 100 : 80 : 95. The first and third cutting of lucerne were superior to the clover and timothy grass both as regards rapidity in increasing live weight and the amount of food necessary to obtain 1 kg. increase in live-weight. The amount of dry matter required to produce 1 kg. increase in live-weight was highest in the case of lucerne, lowest in that of forage-maize (maize cut before the ears were quite ripe), and intermediate between that of timothy grass, the proportion being as 100 : 94 : 91. In comparison with other forages, lucerne is especially rich in digestible protein and poor in digestible fibre.

A ration of lucerne hay + straw + grains proved superior to one of lucerne hay + grain. The ration of mixed hay + grains was superior to the ration lucerne hay + grains, but inferior to the ration lucerne hay + straw + grains. Chopped maize forage was one of the best fodders; on the other hand, timothy grass did not prove so satisfactory. As the result of a comparison between the digestible matter in different foods, the following products were ranged in descending order: barley 100; pea meal 89; bran 70; maize stalks and ears 68; lucerne 64; timothy grass 63; straw 51.

*Comparison between black vetch and lucerne* -- The black vetch, Golden Vine, produced in 1900, 149.3 kg of protein per hectare, and lucerne produced 179.6 kg. The protein of the vetch hay was rather more digestible than that of the lucerne, especially when the vetch had been cut at the beginning of the flowering season when its digestibility is highest. The stems were more digestible than the leaves, in this, black vetch differs from lucerne. The chemical composition of vetch hay cut at the beginning of the flowering season is superior to that of lucerne, but after the flowering is over, the loss of nutritive substances is very rapid.

*Comparison between successive cuts of lucerne* -- As a cattle feed the nutritive value of the first, second, and third cuts of lucerne (19.89 kg. of hay per kg. of grains as basal ration) was respectively 100 — 75 — 110, the relative amounts consumed per head and per day were in the proportion of 100 (viz., 10.5 kg.) 97 105. The third cut contained least dry matter and digestible matter ingested per kg. of increased weight. The five-year average increase in live-weight obtained per hectare was much higher for the first cut and decidedly lower for the third, the proportion being for early cutting, as 100 : 80 : 69.

*Comparison between cutting lucerne early or late.* — The object of these experiments was to determine the best time for cutting lucerne. It was found that as regards the amount of increase in live weight produced per hectare, the relative value of the cuts was as follows: early cut (immediately after flowering) 100; average cut (one week after flowering begins) 71. Cattle fed with lucerne hay, with or without grain supplement,

(1) By grains is understood not only the grain of cereals or other seeds but also their by-products, such as milling offals (bran, sharps etc., cakes etc.). (Ed.)

ate a little more hay per day and made more rapid gains in live weight when given early cut lucerne hay than with late cut lucerne hay. Given equal weights of hay, the earlier cut produced the best results. In the case of the second and third cut, the proportion was as 100 : 85 : 75. The amount of hay consumed per head and per day was about the same whether the hay was cut early or late, although rather larger quantities of the former were eaten than of the latter. The amount of dry matter and digestible matter required to produce 1 kg. increase in live weight was however decidedly less in the case of the early crop and more in that of the late crop.

The proportion for the 3 cuts was as 100: 131: 166.

*Sugar-beet pulp as a cattle feed.* — A larger quantity of dry matter per kg. of gain in live weight was consumed when only lucerne hay + pulp was fed, than when the hay was replaced to some extent by grains. Cattle given lucerne hay + pulp made practically equal live-weight gains through the whole feeding period. Larger and cheaper gains were obtained by feeding grains during the last part of the fattening period than at the beginning. Table I gives a summary of a feeding experiment with lucerne hay, beet pulp and grains which lasted 107 days. It shows clearly that it is very advantageous to feed by-products of milling with beet pulp.

TABLE I. — *Results of a feeding experiment with lucerne hay, beet-pulp and grains*

Ration			Average increase in live weight per head and per day	Kg. of food consumed for 1 kg. increase in live weight			
Lucerne hay	Bran and sharps	Beet pulp		Lucerne hay	Bran and sharps	Beet pulp	Total dry matter
entire	entire	none	725 gm	9.8	4.6	—	12.66
entire	none	entire	670	11.5	—	31.4	13.05
entire	entire	entire	1025	7.2	3.2	17.0	10.68
entire	1/2	entire	825	9.2	2.0	19.1	11.65
1/2	entire	entire	910	4.3	3.6	21.3	8.87

In another experiment, it was found a good plan to add 900 gm. of grains to a ration of lucerne + pulp, because each kg. of grains replaced 3 of lucerne hay, or 17 of pulp. The increases in weight were larger and the production cost diminished when the ration of pulp was limited to 1/4 or 1/2 the amount consumed *ad lib.* by the animals and when lucerne hay was fed *ad lib.*, but not the beet pulp. On limiting the lucerne ration in the same way and giving the stock all the pulp they could eat, the increases in live-weight fell and the cost rose, although it was better to limit the ration of one or other bulky feed than to give both *ad lib.*

*Beet pulp and molasses as feeds.* — More rapid and economical increases in live weight were obtained when molasses was substituted for

part of the grains ration than when grains + lucerne hay were fed. Each kg. of molasses decreased the amount of lucerne hay and grains consumed for 1 kg. increase in live weight by 0.55 kg. and 0.3 kg. respectively.

*Roots as a feed.* — In an experiment lasting 88 days, in which two lots each of 3 animals were given mixed hay + forage maize + grains, the lot receiving 7.4 kg. of mangels per head and per day gained 62 gm. per head per more than those given no roots day. The cattle fattened on ration containing roots lost the most in dressing. In order to replace 794 kg. of dry bulky feed, 4200 kg. of roots, or about five times as much was needed.

*Grass and hay compared.* — In an experiment of 21 days' duration, in which three lots of 3 animals each were employed, it was found that grass is not superior to good hay, and that unripe grass is of less value than ripe grass. Steers at grass require a grazing ground 28 % larger than is necessary for animals fed on cultivated forages. In order to produce 1 kg. of live weight, more dry matter is needed in summer than in winter.

*Comparison between forage plants of different kinds.* — Two years' experiments with steers at grass have shown that the animals do better in a meadow composed of mixed species than in one where only one sort of grass is grown. Of the various species cultivated singly *Avena clatior* ranked first, *Phleum pratense* second, and lucerne third.

*Value of grains in the ration.* — It was found unprofitable to feed grains with lucerne hay during the period preceding fattening. The cost of producing 1 kg. live weight increases as the fattening progresses. There is no advantage in keeping steers for the butcher on rations producing a slight increase in weight during the winter, in order to subject them in the following spring to a short period of intensive feeding.

In one experiment lasting 84 days in which groups of 4 steers were employed and fed an ordinary ration of mixed hay and 1.8 kg. of grains per head and per day, the animals given most roots gained 680 gm. per head and per day, while those fed on straw, or forage-silage, gained respectively 665 and 580 gm. The weights of the 3 feeds consumed were in the proportion of 2.8 : 1.0 : 2.3. Equal amounts of hay and grains were eaten. The steers receiving respectively 1.8; 2.7; 3.6 kg. per head and per day in addition to mixed hay increased in live weight 445; 690; 720 gm. per head and per day. The cost of producing 1 kg. of live weight decreased as the quantity of grains was increased.

*Ration of grains alone.* — Two-year-old cattle fed for 175 days on a ration of grain only gained in live weight 840 gm. per head, per day. To obtain 1 kg. increase in weight, 5.7 kg. of grains were required. When the animals were not given bulky fodder, they drank very little and seldom chewed the cud.

*Value of shelter.* — The best results, both as regards rapid increase in live weight and economy in feeding, were obtained when the animal was allowed to use an enclosed meadow, or a shed, at will. Cattle living in the open eat more than those kept in the stall, but they are more thrifty.

*DAIRY COWS. — Feeding on grains.* — Experiments with lots of 3 cows were made for periods of 21 days, in order to determine the effect

of grains on milk production. In the case of animals given good lucerne hay and 1.8 kg. of a mixture of bran and sharps per head, and per day, it was found that the addition of grains had little more effect than that of an equal amount of lucerne hay. Butter production was cheaper if 1.6 kg. grains was fed instead of 3.2 kg., although the milk yield was a little lower and less regular. The total milk yields were respectively 2154 and 2160 kg. and the butter (water-free) production 112 and 89 kg. An increase in the amount of concentrates did not make the milk richer.

*Comparison between different forages* — Lucerne hay + grains proved more economical for the production of milk and butter than mixed hay + grains, but the amount eaten was about the same. Calculating from the quantity ingested, the ration lucerne hay + forage maize produced milk and butter with a little less dry matter consumption, as compared with the ration of lucerne hay alone. If the calculation is made from the amount distributed, there is practically no difference. The butter of cows fed on lucerne was darker in colour and firmer than that of cows given forage-maize.

*Comparison between the different cuts of lucerne.* — The production of 3 lots composed of 5 cows was recorded for 2 years. It was found on comparing the milk production obtained with lucerne hay of different cuts with the addition of 0.65 kg. mixed grains per cow and per day for each kg. of butter (water-free), per week, that the hay of the second cut is quite equal to the later crops, although not so readily eaten by the stock. Table II shows the value of the different crops of lucerne for dairy cows.

TABLE II — *Value of the different cuts of lucerne  
as a feed for dairy cows*

Costs.	Nutritive units	Butter (water free) produced	Butter per 100 nutritive units
1st	6 381	319 kg	5.00 kg.
2nd	5 828	312	5.36
3rd	6 410	307	4.78

*Value of succulent feeds* — The average of two experiments made in winter with lots containing 6 cows, showed that the value of sugar-beets as regards milk production is only 14 % of that of lucerne hay. Sugar-beets and beet pulp are almost of the same value as a feed for dairy cows.

A slight increase in the butter-fat content of the milk was observed on feeding beets, or pulp, to the cows, but the milk yield and butter production were not perceptibly changed.

*Value of grazing.* — 16 cows were studied for periods varying from 1 to 4 years, with a view to ascertaining the effect of grazing on yield. The passage from dry feeds to the early spring grass greatly increased the milk and butter production and raised the fat content of the milk slightly, for a short time. These effects were more noticeable in the case of cows

at the beginning of their lactation, than in that of animals whose lactation period was far advanced. The lactation of cows stall-fed with grass was longer than that of cows at grass. The change from dry fodder to green fodder did not effect the production of stall-fed animals as much as that of those grazing in the open: 14 grazing cows that were given grains produced 911 kg. of milk and 36 kg. of butter in 108 days, as against 831 kg. and 33.1 kg. produced by cows receiving no supplementary ration. The lactation of the first set of cows being longer, it appears that a *small* ration of grains is advantageous to cows at grass. Cows put out at grass for a short time first lost weight, but afterwards this was regained.

*Food-capacity of the cow and production.* — The cows eating the most were without exception the most productive and the most economical. Cows differing only from one another to the extent of 90-136 kg. or less, showed no certain proportion between production and weight. An inferior cow consumes in proportion to its production more food than a good cow.

*Variations in milk production.* — With the advance of the lactation period, the milk yield of cows decreased about 9 % per month. It has been found that if the amount of butter produced daily about the 6th month of lactation, is multiplied by the number of days the lactation period lasts, a very close approximation to the annual butter production is obtained.

*Value of recording production.* — The records of 26 herds of dairy cows at Richmond (Utah) for a biennial period ending in 1913, proved that the difference between the annual production of butter (water-free) of the best and of the worst cow of a herd ranged from 18 to 148 kg. There is no correlation between the production of the 3 first months and the annual production. There is a decrease in yield when the cow remains dry for more or less than two months. A dairy cow of a good breed shows a marked tendency to long lactation; she is as superior to a poor cow, in annual butter production as in butter production during the first month. Cows calving in the autumn produced during the 12 first consecutive months over 20 kg. more butter than those calving in spring. Although the cost of feeding the former was higher, the average profit per head was 4 10 dollars more than in the case of the cows that calved in spring.

Table III gives a summary of these comparisons.

TABLE III. — *Comparison between the best and the worst herd.*

		The best herd	The worst herd
Annual milk production . . . . .	kg.	4 397	2 232
Annual butter production . . . . .	kg.	149.9	89.4
Cost of feed per annum (1). . . . .	fr.	229.01	177.29
Profit on cow (difference between the value of the milk and the cost of feeding). . . . .	fr.	362.57	174.18

*Skim milk for the feeding of calves.* — Experiments lasting 4 years proved that if properly fed, calves can very well be reared on skim milk. Calves so reared do not increase as much in weight as those given whole milk. The amount of dry matter consumed per kg. of increased weight was practically the same in either case, but when skim milk was given, the rapidity of the increase was only 70 to 80 % as compared with the effect of whole milk. Up to the age of 3 ½ months, calves required less milk and less dry matter per kg. of increased weight than was needed by pigs.

When however the calves were 5-6 months old, they ate a larger amount of dry matter (chiefly in the form of hay), than pigs.

**DAIRY INDUSTRY: BUTTER-MAKING.** — *Skimming milk.* — When a centrifugal separator was used, the loss of butter (water-free) was 2.7, 8.1 and 15.4 kg. according to whether the milk was in shallow or deep bowls respectively. Cold milk and a slow movement of the separator hinder the maximum output, which is obtained at 29-30° C, and by setting the speed prescribed for each type of machine. When milk is set in pans, the skimming operation is performed most satisfactorily the shallower the pan and the cooler the dairy. The temperature of the milk should be kept at 1° C or lower.

*Churning.* — Under average conditions, a cream with 30 % butter-fat can be churned at a lower temperature and more profitably than a cream containing less fat. A higher fat content is sometimes a hindrance owing to the greater adhesiveness of the cream, which tends to stick to the sides of the churn instead of forming butter. Under ordinary conditions, from 0.4 to 0.64 % of acidity has little effect on the result of churning.

**CHEESE-MAKING.** — *Effect of the quality of the milk.* — Better cheese can be made from good milk than from milk of poor quality; 2.52 kg. of fresh cheese per kg. of butter-fat can be made from milk containing 4.8 % of fat, while as much as 2.84 kg. of cheese per kg. of fat can be made from milk with a butter-fat content of 3.4 %. The average obtained was 11.31 kg. of cheese per 100 kg. of milk, or 2.77 kg. per kilogram of butter-fat in the milk. The fat lost in the whey was on an average 0.15 % whatever the fat content of the milk might be.

*Loss of weight during ripening.* — The cheese lost 6.9 % in weight in 1 month and 9.3 % the 6 following months.

*The best temperatures.* — The best temperature for the milk at the time of adding the rennet was found to be 30° C. Ripening the cheese at 18° C and at lower temperatures, had little effect upon its loss of weight. The smell of cheese seems to be affected by the temperature of the vat during the process of cheese-making.

*Paraffined cheese.* — When the pressed cheese was stamped and put into paraffined boxes containing from 2.6 kg. to 13.6 kg., the losses in weight during ripening were lower, and less handling was required; the cost of production was, however, increased from 11 to 34 centimes per kg. During the first 90 days, the paraffined and unparaffined cheeses lost in weight, 5.5 and 8.6 % of their respective weight. Both paraffined and



unparaffined cheeses did best when kept in cold rooms, instead of in ordinary cellars.

**PIG FEEDING.** — *Value of green food* — Pigs eating green food increase more in weight than those that are given none, and they need much less grain to make 1 kg. of live weight. Lucerne is an excellent supplementary forage to feed with grains, but it is too coarse and bulky to be given alone to pigs and does not provide them with sufficient nourishment.

The addition of lucerne to other feeds produced little increase in the weight of the animals.

*Importance of exercise.* — Pigs turned out on to 7 hectares of good meadow land cropped with 8 species of forage, lucerne forming at least one half, grew more rapidly and needed less grains per kg. of increase in live weight, than those of any other group. Pigs weighing about 34 kg., kept feeding in small moveable pens, grew more slowly and required a greater quantity of grains to produce 1 kg. of live weight, than the animals allowed to range at will.

The exercise alone increased the weight of the pigs and the amount of food consumed, while it decreased the quantity necessary for producing 1 kg. of live weight. The results obtained from grazing supplemented by grains were slightly better than from grass fed in a trough, or the farmyard.

*Amount of grains* — As regards the amount of grains necessary for 100 kg. increase in live-weight, the lot of pigs at grass which were given  $\frac{1}{4}$  the whole grains ration were superior to all the others used in the experiment. They needed less food and increased more in weight. A grains ration consisting of wheat bran + maize meal + crushed wheat was a little more effective in increasing live-weight when fed dry rather than moist, but the amount required to obtain 1 kg. increase in live weight was less when the ration was moistened.

*Comparison between different grains* — In the case of pigs from 11 to 19 weeks old, and in experiments lasting 5 months, it was found that more rapid and economical gains were made by the lots given equal parts of peas and bran. Next in order came the mixture wheat + wheat bran followed in descending order by: maize + wheat-bran, barley + wheat-bran. The amounts of the 4 mixtures consumed to obtain 1 kg. of weight were respectively 3.63; 4.02; 4.55 and 4.62 kg., the daily increases in live weight per head being 495 — 313 — 286 — 254 gm. per pig. Other experiments showed that wheat is the best food for pig-raising, both as regards speed and economy in live-weight gains. The nutritive value of maize and barley is about equal, but rather quicker increases in live weight are obtained with the latter. Peas + wheat bran proved a little more satisfactory than the mixture barley + bran.

*Size of pigs and cost of increase in live-weight.* — The amount of grains required per 1 kg. of increase in live-weight was larger as the pigs grew heavier. Animals weighing 34 to 45 kg., when kept entirely on grains, needed on an average 3.79 kg. of grains for 1 kg. increase in live-weight,

while pigs weighing 68 to 91 kg. required 2.4 kg. and those weighing 113 to 136 kg., required 3.24 kg.

*Effect of previous feeding.* — The lots of pigs given a preliminary course of half-rations of grains and grazed on lucerne, increased in live weight more quickly and economically than those previously fed on skim milk. The addition of a small quantity of grains during the preliminary period, decreased the expense and increased the live-weight gain of the pigs given skim milk and turned out to grass during the second period.

*Value of skim milk.* — In an experiment lasting 108 days, 11 young pigs fed exclusively on skim milk increased in weight much more slowly than the others (309 gm per head and per day), and suffered in their general health. With skim milk alone, 33 kg were required to obtain 1 kg. increase in live-weight; with grains alone, 4.70 kg were necessary. If mixed, 7.7 kg of skim milk and 2.92 kg of grains were required. Skim milk is more suitable for very young pigs than for older animals.

Pigs kept in the sty, or in the field, increased in live-weight with practically the same rapidity and consumed the same amount of grains + skim milk to produce 1 kg of live weight (2.18 kg of grains + 18.3 kg. of skim milk in the former case and 2.36 kg grains + 15.4 kg skim milk in the latter).

• *Proportion between skim milk and grains.* — In fattening pigs (for 76 days), the average daily increases in live weight were highest (735 gm per head) when the skim milk was fed in the proportion of 5 times the weight of the grains, than when larger amounts were given (650 gm increase), or when grains alone were given (305 gm. increase). In the case of older animals, the best proportion was 1 kg of grains per 3 kg, or less, of skim milk. In all cases the youngest pigs increased in weight more rapidly than the older animals.

*Comparison between whole milk and skim milk* — As compared with skim milk, whole milk can be used to replace double the grains in a ration of milk and grains. The addition of grains to whole milk nearly doubles the nutritive value of the latter.

*Succulent Foods.* — For pig-feeding, apples have little more value than an equal weight of grass. It required 4.08 kg of apples + 2.08 kg. sharps + 4.17 kg. skim milk to produce 1 kg. increase in live weight, as against 2.55 kg of sharps + 3.5 kg of skim milk in a ration without apples. Forage silage is of no use to pigs. The addition of roots to a basal ration of grains decreased the rate of the increase in live weight and lowered the dressing yield: 3.9 kg of roots are required to replace 1 kg. of grains.

*Molasses and sugar-beets as a feed.* — A ration of skim milk + sharps + molasses given to pigs feeding on lucerne, increased the live-weight 513 gm per head and per day. Without the skim milk, the gain was 327 gm and without milk or molasses, it was only 227 gm. For pigs that have not the run of a meadow, molasses is a very economical feed. Molasses can well replace an equal weight of sharps.

*SHEEP FEEDING* — *The nutritive value of certain kinds of grains.* — Lambs given lucerne as a bulky feed made the following increases in live

weight per head: wheat grain 52 gm.; whole wheat meal 50 gm.; grains + wheat bran; 54 gm straw + grains 47 gm. In order to produce 1 kg.

TABLE IV. — *Lamb feeding experiments.*

Ration	Daily increase in live weight per head gm.	Kg. of food consumed to produce 1 kg. increase in weight				
		Lucerne	Grains	Pulp	Molasses	Dry matter
Lucerne hay + grains . . . . .	99	6.35	2.69	—	—	8.04
Hay + bran + molasses . . . . .	91	8.10	1.50	—	1.42	9.52
Hay + pulp <i>ad lib</i> . . . . .	94	7.97	—	17.86	—	8.00
Hay + limited ration of pulp . . . . .	60	12.53	—	15.17	—	11.89
Hay + pulp <i>ad lib.</i> + grains . . . . .	150	4.23	1.56	10.14	—	5.13
Hay + limited ration of pulp + grains	97	6.45	2.39	9.45	—	8.37

increase in live weight, the lot fed with grains ate nearly double the amount consumed by the lot given straw + grains, but the latter ate the largest quantity of bulky feed (13.43 kg lucerne hay + 0.81 kg straw), and the lot having grains ate the least (8.47 kg. lucerne hay). The cost of production was lowest in the case of the lot given straw + grains and highest in that of the lot fed whole wheat meal.

The best ration for fattening lambs was lucerne hay + mixed grains, or lucerne hay + grains with or without beet pulp. Table IV gives a summary of the results of a 78 days' experiment with 17 lambs per lot.

*Rations containing pulp* — In an experiment lasting 107 days, with 16 sheep in each group it was found that the lowest daily gains in weight were made and the largest quantities of dry matter consumed when the ration consisted only of lucerne hay + pulp, although if grains were also added, the daily gain was still further reduced. The results of this experiment are given in Table V.

TABLE V. — *Experiments in Sheep Feeding.*

Lucerne ration	Bran and sharps ration	Pulp ration	Increase in weight per head and per day gm.	Kg. of foods consumed to make 1 kg. increase in weight			
				Lucerne	Sharps and bran	Pulp	Dry matter
whole	whole	0	73	6.5	5.5	—	10.49
whole	0	whole	32	16.6	—	36.7	18.06
whole	whole	whole	91	5.3	4.7	11.2	9.77
whole	$\frac{1}{2}$	whole	86	5.9	2.5	11.8	8.50
$\frac{1}{2}$	whole	whole	73	3.7	5.9	15.1	9.78

*Value of roots.* — Although the dressing loss was greater when roots were added to the rations, the sheep increased more in live weight during the fortnight's experiment when 921 kg. of roots were given in the place of 86 kg. of grains + 175 kg. of hay. An increase in weight of 82 gm. per head and per day was made during 112 days by sheep fed only 1.3 kg. of roots + 0.34 kg. of grain.

*Comparison between different forages* — In the experiments without supplementary feeds, it was found that lucerne hay is a much more satisfactory forage than meadow hay or timothy grass hay. Meadow grass hay fattens sheep better than timothy grass hay. Less increase in weight was obtained from forage silage added to a ration of grains + hay than from dry maize forage.

*Shelter.* — Sheep kept in the stalls increased more in weight than those in the sheds.

*HORSE FEEDING* — *Comparison between lucerne and timothy grass.* — Draught-horses fed lucerne hay maintained their live weight more easily, ate more bulky feeding stuffs and were in better condition than those given timothy grass hay. The former drank more, but the amount of water consumed per unit of dry matter was larger in the case of the horses fed on timothy grass hay. Resting horses were kept in good condition when receiving 9 kg. of lucerne per head and per day, but 15 kg. were required when the animals were working hard. Not more than 9 kg. of lucerne hay should however be given to horses engaged in heavy work, the rest of the ration ought to consist of grains.

*Value of chopped hay* — Chopping hay and mixing it with grains was not found satisfactory and even proved injurious in the case of timothy grass hay, owing to the irritation produced in the mucous membrane of the mouth. Finely chopped lucerne or clover on the other hand gave excellent results.

*Comparison between different grains.* — The live-weight of horses is not so well maintained in summer with a ration of maize + timothy grass as with oats + wheat + clover. During the winter, the value of both rations was practically equal. In spring and summer, maize is a better supplement than oats to a ration of mixed hay + wheat or bran. Sharps and bran can be advantageously used in place of oats, if they are fed with lucerne hay, or timothy grass hay. Grains fed to horses should not be ground.

*Amount of grains.* — Moderate rations of grains were relatively more effective than larger rations, but horses, like cattle, thrive well on relatively large quantities of grains. In summer horses eat smaller quantities of grains in proportion to hay than they do in winter.

*Composition of the ration.* — A small quantity of protein (about 127 gm. per head and per day), proves as beneficial with horses as double that amount. The nutritive ratio as 1 : 15 was as satisfactory as a much closer ratio. In the case of horses, the value of foods seems to depend more on the number of calories than on any other factor. There also seems to be a direct connection between the digestible matter of a forage and its nutritive value.

*Watering.* — The best time for watering horses is immediately before meals. Horses that drink before they eat have larger appetites.

*Moist beetroot pulp as a food.* — Up to 9 kg. of pulp can be fed to horses per head daily without any apparent ill effects. In a ration of lucerne hay + oats, 9 kg. of pulp take the place of 1.5 kg. of oats.

*Use of cover-cloths.* — It is not advisable to cover horses in the stable at night, even in the coldest part of the winter.

**POULTRY REARING.** — *Registration of production.* — The use of trap-nests can be superseded by external palpation which enables 99.5 % of the eggs being registered with certainty (1).

*Annual food consumption.* — The annual food consumption per fowl was : Leghorn 34 kg. (25 kg. of dry matter) ; Wyandotte 45 kg ; Plymouth Rock 50 kg. The hens reached their maximum weight just before the chief laying period, during which they lost weight.

*Advantage of exercise.* — The results were obtained with Barred Rock and White Plymouth Rock fowls by giving them a scratch food, but this was of no advantage in the case of Leghorns. Young fowls that were allowed plenty of exercise laid more and heavier eggs, with a higher percentage of fertility, than the hens confined in a run.

*Average egg-production (2).* — The study of all the available records of single combed Leghorns has shown that fowls of this breed lay until their 6th year. Their average production is about 130 eggs the first year ; 120 the second ; 110 the third ; 85 the fourth, and decreases by 10 for every successive year until the eighth.

In a flock of good layers, the hens producing a large number of eggs the first year continue to be prolific until their second, or third year. The largest number of eggs is however generally not laid the first season. In fact, nearly all the fowls of a flock of very high egg production at the Experiment Station of Utah, were mediocre or bad layers the first year, hence the real index of the value of a hen is its egg production during the 3 first years of egg-laying. Most long-living hens lay over 500 eggs ; the majority produce over 600, while some hens lay 800, or even more.

*Selection based on egg-production.* — The total egg production of a flock during the first 3 years appears to average about the same as its production the first year, but if the first year is high, the production of the following years is considerably increased by the selection of the best layers. Surrounding conditions have much more effect upon the egg production of a flock during the first year than later, and these factors influence a flock of low production more than one of high production. The egg-laying period of equally good flocks is about the same for each of the first 3 years. The difference in the performance of good and bad layers remains fairly constant throughout the year. If the good and bad layers of the same flock are compared, it is found that the bad layers fall off a little more rapidly in egg production during the second half of the first year

(1) See *R.* April 1919, No. 497. (Ed.)

(2) See *R.* March 1915, No. 310. (Ed.)

and not so quickly the second year. The distribution of egg production does not appear to depend upon age, at all events, not before the hens are 3 years old, but the total production has an influence on distribution quite independently of age. The distribution of production in dual purpose breeds differs from that in the case of laying breeds (Leghorns) in which the maximum production is reached earlier and decreases more gradually.

*Egg-production during winter* — In winter time, egg-laying appears to be influenced by external conditions and varies therefore from one year to another. The larger the number of eggs a fowl lays, the higher is the percentage of those laid in winter. Under normal conditions, pullets lay more eggs in proportion during the winter than are produced by older hens.

*Early hatching* — The date of hatching had no effect upon the 3 years egg production of birds hatched between March and the end of April, but the fowls that began laying last were always poor layers.

*Colour of the eggs* — In the case of breeds laying eggs of variable colour, each hen usually lays eggs of a uniform shade which makes it possible to obtain by selection a breed producing eggs all of the same colour. The colour of the egg-shell is an individual peculiarity, but the colour of the yolk is altered by feeding. Green foods such as the leaves of lucerne, produce a yolk of normal colour, not of a pale shade.

*Size of the eggs* — Great differences were observed in the size of the eggs laid by various breeds, individual variations also existed between hens of the same breed. Adult Leghorn hens laid eggs weighing 55 % more than those of pullets belonging to the same breed. The Barred Plymouth Rock is not inferior to the Leghorn as regards the size of its eggs, but Wyandotte eggs weigh 77 gm more per dozen than Barred Plymouth Rock eggs and Light Brahma eggs are 11.5 % heavier.

*Incubation* — Eggs in an incubator decrease in weight much faster than those under a hen, which shows that they have much more ventilation in the incubator. The large moisture content of the air in the incubator proved also very favourable to hatching out many and heavy chicks. Under conditions of great humidity, the eggs lose 12 % of their weight by evaporation, instead of 14 and 18 % respectively when the surrounding air is fairly moist, or dry. The best results were obtained during the first second and third successive periods of 6 days, by bringing up the moisture to 4 — 5 — 6 % respectively, or with about 15 % moisture during the whole incubation period. The necessary moisture is better supplied by damp sand rather than by free water.

The carbon dioxide content of the air was considerably higher under the hen than inside the incubator, but the amount present in the latter had no effect upon the number of chicks hatched out. The carbon dioxide of the air unites with the water in the egg and softens or dissolves the egg-shell. This is probably one of the principal reasons why the high moisture content of the air in the incubator has such a beneficial effect.

*Ducks.* — To rear ducklings up to the age of 9 weeks it was necessary to give them for every kg of increase in live-weight, 3.02 kg. of grains +

3.02 skim milk + 0.16 kg. meal scrap. When the birds were older, they ate still more.

*Turkeys.* — The quality of the meat is much improved by fattening turkeys in small flocks kept in small enclosures, and feeding them with wheat, and maize, meal mixed to a paste with skim milk, sugar-beets, and green lucerne. The birds should be supplied with plenty of gravel.

F. D.

604 - **Breeding Morgan Thorough-Breds on Government Farms in the United States.** — REESE, H H, in *U S Department of Agriculture, Department Circular* 199, pp 1-18, figs 13, 1 pl Washington, Nov 1921

HORSES

The specific characters of the Morgan horses, which constitute a national American breed, are well-known. The breed originated about a century ago from a single stallion of exceptional prepotency. In spite of the unusual qualities of this breed, no care has been taken until recently, either by private individuals or the State, to maintain its purity, so that most of the horses are the results of unsuitable crosses and have lost their original qualities.

In 1906, on the initiative of the Ministry of Agriculture and of the Experimentation Station of the State of Vermont, a small lot of stallions and brood-mares were collected for the first time near Burlington; in 1907, these animals, together with some others were transferred to a farm near Weybridge, presented by private individuals to the Government of the Union, and officially known by the name of the "U S Morgan Farm". The farm was subsequently enlarged and now includes about 400 hectares. It is provided with modern and first-class stabling etc., and continues successfully the work of preserving the breed, by collecting together numerous stallions and brood-mares from the different States of the Union.

Systematic breeding has produced a considerable increase in the weight and size of the individual animals, even in the course of a few years, and has succeeded in fixing all the special characters of the breed.

E. F

605 - **Trade in Irish Horses.** — *Department of Agriculture and Technical Instruction of Ireland*, Vol XXI, No 3, pp 310-313 Dublin, 1921

Before the War, pure-bred Irish horses were largely reared for hunters and light riding-horses. During the War, the cessation of all hunting, and the fact that a type of heavy animal was necessary for the artillery caused a sudden and considerable drop in the number of light Irish horses sold, and a great rise in the price of the heavy type of agricultural horse. The number of horses in Ireland for each year from 1914 to 1920 was respectively: agricultural horses 393 646; 359 848; 382 271; 389 711; 413 617; 407 748; 399 889; total 619 345; 560 917; 598 978; 597 692; 618 807; 624 501; 624 266; The number of horses exported during those years, not counting those destined for the army, were respectively: 30 940; 17 818; 6 878; 5 602; 20 081; 21 782; 24 824. Thus the exportation of good light horses was resumed at the end of the War. Since 1919, horse-breeding in Ireland has assumed its

pre-War proportions and has been much improved by the Horse Breeding Act of 1918, which came into force in January 1920, and prohibits the use of unlicensed stallions for service.

In a normal year, horses are exported from Ireland to the value of £1 250 000 to £1 650 000. The animals are crosses between a pure-blood Irish stallion and an ordinary mare; according to the type of the mare, the products are hunters or army horses cavalry horses, remounts and artillery horses.

The hunters fetch from £40 to £100 or more; the draught-horses £40 to £50, and good army horses from £30 to £40, or £40 to £50 if from 4 to 5 years old and trained.

During the pre-War period, Irish army horses were exported only to France, Italy, Germany, and Austria, while draught horses were sent to Holland, Belgium and Italy. With the return to normal conditions, these countries have resumed the importation of horses from Ireland and other countries are beginning to follow their example.

During the War, the Irish horse proved a great success, especially the "gunner", or light artillery type. F. D.

#### CATTLE

606 - **Frisian Cattle.** — GAUDOT, G., in *Journal d'Agriculture pratique*, Year 86, No. 12, pp 246-248, figs. 3. Paris, March 25, 1921.

The author gives reproductions of photographs of two fine Frisian cows sent to him by the Frisian Federation of Agriculture, at Lecuwarden, together with an account of the milk yield of the animals at different ages. For the first year, the figures were respectively as follows: duration of lactation at 2 - 9 - 10 years: 323 - 322 - 326 days; milk yield 4540 - 7377 - 8774 kg.; fat 3.46 - 3.35 - 3.05 %; butter production 170 - 267 - 287 kg. For the second year, duration of lactation at 5 and 11 years of age respectively: 330 and 327 days; milk yield 9012 and 9296 kg.; fat: 3.20 and 3.10 %; butter production 310 and 310 kg.

The author gives, in addition, some information respecting stock-breeding in the Province of Frisia.

Meadows cover two-thirds of its surface, only 50 000 hectares, or 15 % of the whole Province is arable land. The meadows occupy clayey tracts, or drained peat bogs, and are some of the most luxuriant in the Netherlands.

Stock-breeding is therefore the chief agricultural industry of Frisia.

The number of cattle is estimated at 300 000 head; this includes 200 000 cows and 100 000 young animals, bulls etc. This herd is composed of the Frisian variety of the Dutch Black Pied breed.

A special Herdbook for the Frisian variety was started in 1879; at the present time 3 500 breeders are members. No cows of bad conformation with poor milk yield, or giving milk with low fat content are registered. The milk yield of each separate cow is tested throughout the whole lactation period at intervals of 15 days at most.

During the summer, the cows are kept in the fields night and day and grass is their only food: in the winter, they are stall-fed and receive



hay as well as a small amount of concentrates, such as cakes, meals etc. They are milked twice in the 24 hours.

The average yield of the lactation period, 330 days at longest, is 4 500 kg. of milk with a fat content amounting to 3.3 %

Owing to the importance of the dairy industry, many pigs are reared. The number of head before the War was about 100 000. Breeding, which had decreased during the years 1917 and 1918 owing to lack of food, especially of cakes, has gradually acquired its former proportions. Two Herdbooks have been started, one for the old native breed and the other for the selected breed. The animals are registered at the stock-breeding Control Stations. The sheep kept are fewer in number than the pigs, they are estimated, before lambing, at about 90 000 head. The Frisian breed of sheep is noted for its milk-yielding capacity. A Flock-book was started in 1908. Sheep are mentioned which at the age of 3 years have given 658 and 734 kg. of milk with a high fat content. F. D.

607 - **The Dual Purpose Shorthorn Breed.** — ИОВЫС, R., in *The Journal of the Ministry of Agriculture*, Vol XXVIII, No 4, pp 302-305 London, 1921

The Dairy Shorthorn for beef and milk production, has been the breed reared by preference, for more than a century, by the small farmers of the United Kingdom; it continues to spread in new countries wherever increasing population necessitates the production of the largest possible amount of human food, a condition of affairs obtaining in the Eastern part of the United States, South America, South Africa, New Zealand, etc

In its own country, this breed has passed through crises threatening its existence. Of these the most serious was at the time when Argentina required beef-producing animals for breeding, which led to the crossing of good dairy Shorthorns with Cruickshank bulls, which are exclusively beef-animals.

Some far-seeing breeders succeeded in persuading the Shorthorn Society to award prizes at the chief Agricultural Shows of the United Kingdom to good Shorthorn milch cows. They subsequently founded the Dairy Shorthorn Association affiliated to the Shorthorn Society. It encouraged the testing of milk yield in herds of pure-bred animals and undertook the publication of the Register of Non-pedigree Dairy Shorthorns, animals whose descendants may gradually acquire the characters required for their registration in the Herdbook of the pure breed.

The Government Live Stock Improvement Schemes, which included prizes offered by the Ministry of Agriculture for the production of superior animals for the market, and special prizes given to Societies testing milk yield, have greatly encouraged the breeding of fine beef bulls, the offspring of excellent milch cows and, at no time has the importance of the dual-purpose animal and the Shorthorn milch cow been better appreciated.

In 1914, the Dairy Shorthorn Association boasted of 214 members, owning 55 herds; 337 milk yields were registered on its books. In 1920, the members had increased to 631, the herds to 332, and the milk yield

entries to 1194. In December 1918, this Association published the first volume of the Register of Non-pedigree Shorthorn Dairy Cows on which about a thousand tested and approved cows are entered as founders. One result has been the increased price of good registered milkers of mixed breed; these animals now realise from £107 to £114. An approved cow may be entered on the Dairy Shorthorn Register when its milk yield has reached 7000 lbs in one year, or 6000 lbs. in two successive years.

F. D.

**608 - Comparative Study of Maize Silage and Sorghum Silage for Fattening Cattles. —**

I. WILSON, Y. W., and KUHLMAN, A. H., Corn and Millet Silage for Fattening Cattle, in *South Dakota State College of Agriculture and Mechanic Arts, Agricultural Experiment Station, Bulletin No 189*, pp. 205-220 Brookings, 1920 — GOOD, E. S., HORLACHER, L. J., and GRIMES, J. C., A Comparison of Corn Silage and Sorghum Silage for fattening Steers, in *Kentucky Agricultural Experiment Station, Bulletin, 233*, pp 61-89, figs. 8. Lexington, 1921.

I. The report is a description of two experiments in feeding cattle: the first was made with the purpose of comparing the silage of the sweet varieties of maize known as "Rainbow Flint", which are early and glutinous, and "Reed Yellow Dent". The data refer respectively to groups 1-2-3-4. In the second experiment, a comparison is instituted between silaged, ripe, White Dent; unripe, White Dent; and "proso", a variety of sorghum; the data refer to groups 2-3-4, while the first group serves as a control. The groups in the first experiment, which lasted 90 days, from February 1919, were composed of 5 steers each; those of the second, which lasted 120 days from January 1920, each consisted of 4 steers. Table I gives a summary of the most important results. The authors do not advise the use of sweet maize and proso for silage, and consider that green Dent should only be used for this purpose in cases of necessity.

Each steer that was completely fed, that is, given all the food it could consume, received in addition to silage, 1.36 kg. linseed cake extracted by compression.

During the last 3 months of the second experiment, oat straw was placed in the food racks, but the animals ate relatively little of it. Group I of the second experiment received maize grain, linseed cake, and meadow hay. The animals gained 118 kg. per head in live weight, which was more than was gained by the other 3 groups for which it served as a check. The increased weight did not however cover the higher cost of the ration without silage. This group consumed for every gain of 1 kg. in live weight: 3.6 kg. hay + 7.67 kg. maize grain + 1.09 kg. linseed cake + 0.99 kg. oat straw.

II. In the 3 experiments, the steers were fed maize + cottonseed cake + maize silage, or sorghum silage + straw. In one experiment, maize stalks (stover), were added to the ration. In all 3 experiments, the animals that had been given maize silage made a greater increase in live-weight, on an average 109 gm. per head and per day, than

TABLE I. — *Comparison of different kinds of maize silage and proso silage for fattening steers.*

Experi- ment and group	Composition of silage			Average initial weight per head	Daily increase in live-weight per head	Food consumed per kg. increase in live-weight		
	Water	Crude protein	Crude fibre			Silage	Linseed cake	
	%	%	%	kg	kg.	kg.	kg.	
I	1	64.0	3.32	7.84	392	0.99	25.4	1.16
	2	77.2	2.20	5.78	391	1.30	18.5	0.88
	3	74.8	2.65	5.35	391	1.25	23.1	0.91
	4	78.0	2.24	5.51	390	1.21	23.6	0.95
II	2	56.2	5.59	8.63	458	1.06	27.8	1.22
	3	87.7	1.69	3.80	446	0.95	39.6	1.36
	4	74.4	4.01	6.10	441	0.83	40.8	1.56

the steers receiving sorghum silage. Table II summarises the results and shows the increase in live-weight.

TABLE II. — *Weight of food necessary for 1 kg. Increase in live weight.*

Forage Silage	1st experiment (99 days)				2nd experiment (150 days)				3rd experiment (165 days)			
	Maize cobs (1)	Cottonseed cake	Silage	Straw	Maize grain (2)	Cottonseed cake	Silage	Straw	Cottonseed (3)	Cottonseed cake	Silage	Straw
Maize . . . . .	0.83	1.62	20.7	2.28	2.39	1.80	21.3	0.2	3.73	2.05	23.0	1.47
Sorghum . . . . .	1.02	2.24	26.7	3.02	2.59	1.96	23.2	0.4	3.80	2.10	24.0	1.62

(1) Only the last 35 days — (2) The last 90 days. — (3) The last 105 days.

As compared with maize silage, sorghum silage contains less protein and a little more crude fibre, expressed as kg. of dry matter. The five-year average of forage per hectare was 241 quintals of maize silage and 376 quintals of sorghum silage. The amount of maize silage supplied by 1 hectare supplemented by the above-mentioned rations produced 1116 kg. of beef, whereas sorghum silage under the same conditions produced 1532 kg. The chief advantage in substituting sorghum for maize as a forage for silaging lies in the fact that sorghum is more resistant than maize to drought and frost. Taking everything into consideration, the value of sorghum silage (expressed as surface unit), is

92.2 % as compared with maize. At equal weights, the value of sorghum is 72.2 % that of maize silage. F. D.

609 - **Silaged Forages for Milch Cows, in Great Britain.** — I ROBERTSON, G. S. (Queen's University of Belfast) and PITCHER, F. J., Silage for Dairy Cows, in *The Journal of the Ministry of Agriculture*, Vol. XXVIII, No. 6, pp 506-515 London, 1921. — II WHITE, R. G. and ROBERTS, E. J., Silage for Milk Production, *Ibidem*, Vol. XXIX, No. 1, pp 34-37. April 1922.

In districts where the compact soil and scanty rainfall make it difficult to grow roots, the latter can advantageously be replaced as a stock feed by silaged forages. This is the case in Essex, the driest county of Great Britain, which has an annual rainfall of only 490 mm. The authors' experiments were carried out in that county, at Burnham-on-Crouch.

The forage grown there for silage was a mixture of vetch, oats and beans. The silo was made of planks of wood. About 13 tons per hectare of silaged forage were made of which the percentage composition was as follows: Water 70.84; fat 1.43; crude protein 4.86; carbohydrates 10.46; crude fibre 9.32; ash 3.09.

The following were the experimental rations.

A) fed during 91 days in 2 periods: 22.7 kg. of mangels + 4.5 kg. meadow hay + 8.2 kg. chopped oat straw + 1.8 kg. dry brewers' grains + 2.3 kg. concentrates.

B) fed during 81 days in 2 periods: 22.7 kg. silaged forage + 4.5 kg. of hay + 1.8 kg. dry brewers' grains + 1.4 kg. concentrates. The latter consisted of 3 parts decorticated cotton-seed cake + 2 parts bean meal.

Ration A contained about  $\frac{1}{3}$  more dry matter than ration B, and its starch value was higher (7 kg. as against 6.1 kg.). The method of alternate rations was adopted. During the periods when they were fed on mangels (ration A), the 11 cows yielded 3963 kg. of milk; when given silaged forage (ration B), the 11 cows yielded 4028 kg. of milk, therefore silaged forage gives the most satisfactory results from the point of view of production. As a rule, the milk obtained from feeding mangels contained 3.69 % of fat, but when the cows were given silaged forage the fat content rose to 4.60 %. It can thus safely be assumed that silage does not impair the quality of the milk, so that the prejudice shown in some quarters against using the milk of cows fed on such forage is not justified. The milk must be cooled slowly and kept where there is no strong odour of silage; if this is done milk will remain sweet and free from any unpleasant taint.

In the rations used in the experiments, 22.7 kg. of silaged forage replaced 22.7 kg. of mangels + 8.2 kg. of oat straw + 0.9 kg. of concentrates. As regards the latter at all events, the ration containing silage would appear to be more economical.

II. Experiments carried out on two farms near Denbigh (Wales), with 8 cows per lot which were fed with the two experimental rations alternately.

A) 183 kg silaged forage + 27 kg hay + 18 kg oat straw + 36 kg mangels + 09 peanut cake + 14 kg soy-bean cake + 07 kg oats + 035 kg barley,

B) 182 kg mangels + 68 kg hay + 18 kg oat straw + 09 kg peanut cake + 14 kg soy-bean cake + 05 kg barley

The two rations were calculated so as to supply equal quantities of starch values and of protein (57 kg and 123 kg per head and per day respectively) The silage was a mixture of oats and peas

On one farm, the average milk production per head and per day for all the cows was preliminary period 82 kg, ration with silaged forages 81 kg, transition period 69 kg, period with mangels + hay 66 kg, on the other farm 86, 78.5, 76, 76 kg respectively Thus, the milk yield was rather higher with the ration containing silage

F D

610 - Studies made at the Maine Agricultural Station (United States), on the Lactic Secretion of different Breeds of Cattle. — I PEARL, R. GOWEN J W and MINER J R, Studies on Milk Secretion Transmuting Qualities of Jersey Sires for Milk Yield Butter Fat Percentage and Butter Lat in *Maine Agricultural Experiment Station Bulletin*, 281, pp 89 204 figs 3 Orono 1919 — II GOWEN J W Report of Progress on Animal Husbandry Investigations in 1919 *Ibidem Bulletin* 283 pp 49 284 figs 7 1919 — III GOWEN J W Studies in Milk Secretion On the Variations and Correlations of Butter Fat Percentage with Age in Jersey Cattle *Ibidem Bulletin* 84 pp 211 296, 1919 — IV GOWEN J W The Variation of Milk Secretion with Age in Jersey Cattle *Ibidem Bulletin* 286 pp 49 60 1920 — V GOWEN J W The Correlation between the Milk Yield of One Lactation and that of Succeeding Lactations *Ibidem Bulletin* 291 pp 121 132, 1920 — VI GOWEN, J W The Correlation between Butter Fat Percentage of one Lactation and Butter Fat Percentage of succeeding Lactations in Jersey Cattle, *Ibidem Bulletin* 291, pp 145 156, 1920 — VII GOWEN, J W Studies in Milk Secretion On the Influence of Age on Milk Yield and Butter Fat Percentage as determined from the 365 Days Records of Holstein Friesian Cattle, *Ibidem Bulletin* 293 pp 185 196, figs 2 1920 — VIII GOWEN, J W Inheritance in Crosses of Dairy and Beef Breeds of Cattle *Ibidem Bulletin* 295, pp 217 221 1920 — IX GOWEN J W, Report of Progress in Animal Husbandry Investigations in 1920 *Ibidem Bulletin* 299, pp 85 120, figs 7 1921

THE POWER OF JERSEY BULLS FOR THE TRANSMISSION OF GOOD QUALITIES OF MILK YIELD AND BUTTER PRODUCTION — The authors had at their disposal 225 Jersey bulls registered according to their transmitting qualities which had been ascertained in each case by the difference between the production of the animal's daughters and that of their dam Each bull was required to have at least 2 daughters entered on the Registry of Merit on which their dam was also recorded In order to be able to estimate the production, the milk yield was in every case brought up to that of the dam at 8 years of age, and the butter content of the milk when she was 2 years old A sire whose daughters are superior to their dam, both as regards milk yield and butter production is regarded as ranking above a bull, whose daughters are inferior to their dam in both these respects There were 28 "superior" and 40 "inferior" bulls These two groups were the object of the most careful study

It was found that the bulls of the "inferior" group were a little more closely related than those of the others and possessed fewer ancestors that had been imported directly from the Isle of Jersey.

The study of the genealogical tree of these two groups of bulls showed that all animals appearing more than 4 times on the male side, or more than 3 times on the female side of the tree of the "superior" bulls also appeared in the pedigree of bulls with an inferior power of transmission. This proves that the presence of one outstanding animal in the pedigree of a bull is not sufficient to guarantee value as a sire.

The authors have also studied the transmission of qualities from the bull to its male offspring as shown by the production of their daughters.

I. STOCK-BREEDING STUDIES MADE IN 1919 AT THE MAINE AGRICULTURAL STATION. — GOWEN used the Advanced Registry of the Holstein, Guernsey and Jersey breeds in order to determine the correlation between the age of the cows at the time of the milk yield test necessary for their entry on the register and the amount of milk they produced in 365 days. The average age for maximum milk yield was 8 years, 1 month and 13 days for Jerseys, 8 years 4 months and 29 days for Holsteins; 9 years, 8 months and 5 days for Guernseys.

The author examined statistically the registered milk yield of 88 Jersey cows with the object of discovering how far it was possible to determine exactly the milk yield of the first 5 lactation periods of a cow, from her milk yield during any one given lactation period. He took into account only the first 8 months of each lactation period. The results showed that the correlation between the total milk yield of 5 lactation periods and the milk given by a cow at 2 years of age is + 0.74, if the estimate is based on one lactation period; when the cow is older, the correlation is higher.

In the case of Holstein-Frisians, the average correlation coefficient between the yield of the 7 days test period and that of the 365 days period is + 0.57, if the 7 days are included in the 365 days, but it is only 0.55 when they are not so included (1).

(1) Another work on the same subject is W. W. YAPP's, Study of the Relative Reliability of Official Tests of Dairy Cows, in *Illinois Agric. Exp. Station Bulletin*, No. 215, pp. 323-339, figs. 7, 1919. The author institutes a comparison between the official tests (those lasting 7 days) of Holstein cows before entry on the Advanced Registry and those of the "semi-official" test, lasting for one year. In confirmation of the generally accepted opinion that the semi-official test gives an exact measure of the actual annual milk production, the author mentions the data obtained respecting the annual butter yield of 30 cows belonging to the herd of the Illinois University.

This is estimated by the semi-official method (the monthly percentage of the butter fat in the milk being based on that found in the milk of 2 days), was 185.4 kg  $\pm$  3.7, whereas the amount determined in the daily samples taken from the mixed milk of the 30 cows was 188.5 kg  $\pm$  3.7. Allowing for probable error, the difference is negligible.

With the assistance of the Holstein-Frisian Advanced Registry which he used until May 1, 1915, the author made a statistical study of the one year tests and of the 7 days tests. During the former, there was a continual uniform increase in the butter fat percentage, and

An examination of the points accredited by show judges for conformation and for actual milk yield during 365 days proves that frequently no correlation exists between them, although the correlation was negative in only one of the cases investigated by the author. The maximum correlation,  $+0.194$ , is found between the total points accredited and the actual milk yield. The external characters in clearly significant correlation with milk production are: the mammary veins, the size and condition of the udder; the size and shape of the posterior "quarters" of the udder, the shape and size of the body; the general appearance of the cow (1).

Crossing experiments between beef breeds (Aberdeen-Angus) and dairy breeds (Jersey and Holstein-Frisian) show that the low yield of the Aberdeen-Angus is recessive with regards to the higher yield of the Jersey, and the yield of the Jersey is in its turn recessive to the higher yield of the Holstein-Frisian.

III. VARIATIONS AND CORRELATIONS OF BUTTER-FAT PERCENTAGE WITH AGE IN JERSEY COWS — This article has also been published more in detail in *Genetics* Vol. V, No. 3, pp. 249-324, 1920. It is a biometric study of the fat-percentages in the milk during the first 8 months of 1713 lactations of a herd of Jersey cows with very fixed characters. This is the same herd that was employed in the researches described in the following section (IV).

It was found that the percentage of butter fat in milk slightly decreases with age, assuming that this diminution is uniform, this relation may be expressed by the formula:

$$f = 5.332 - 0.0191 x$$

where  $f$  = butter fat content of the milk and  $x$  = the age in years of the cow at the beginning of the lactation. In the case of older animals, the observed averages deviate considerably from the averages calculated according to the above formula, but this is explained by the few cases under consideration.

butter production, during the latter there was a uniform increase in the percentage as long as the weekly yield of butter (water-free) remained between 3.6 kg and 10.9 kg., but the increase was sudden and abnormal when the weekly yield was higher. The average percentage of fat in the weekly tests reached  $3.679 \pm 0.01$ , and in the annual tests, it was  $3.434 \pm 0.006$ . As the probable error is slight, this difference is certainly significant. The percentages obtained from the weekly tests were much more variable than those yielded by the annual tests, the typical variations being respectively  $0.526 \pm 0.007$  and  $0.317 \pm 0.004$ . The correlation between the milk yield during the 7 days test and that of the 365 days test was  $0.702 \pm 0.01$ . The correlation between the percentage of fat in the milk obtained during the 7 days test and the 365 days test was  $0.703 \pm 0.01$ . Although these figures are high, they are not high enough for correlations between two measures of the same product. The author deduces from all these data taken together that the 7 days' test does not give sufficiently satisfactory results to serve as a basis for estimating the annual butter production (Ed.)

(1) See *R* April 1922, No. 455, IV (Ed.)

GOWEN also gives a series of coefficients showing the connection between the percentages of the butter fat percentages of the different lactations taken singly, or in groups. These coefficients are of practical importance, inasmuch as they make it possible to estimate the effect of unfavourable conditions supervening during a given lactation.

IV. THE VARIATION OF MILK SECRETION WITH AGE IN JERSEY COWS. — This work was also published more in detail in *Genetics*, Vol. V, No. 2, pp. 111-188, figs. 9, 1920. It is a biometric study based on the data afforded by 1741 lactations, and the total milk yields for the first 8 months of each lactation of Jersey cows in a herd of which the production has been registered since 1897. The herd has always been kept in a uniform manner, no selection based on performance having been practised.

By the method of least squares the author has obtained the following formula to express the change in milk yield consequent upon age :

$$y = 3357.912 - 99.883 x - 0.487 x^2 + 2596.219 \log. 10 x.$$

where  $y$  is milk yield in pounds and the cow's age in years is  $1.25 + 0.5 x$ .

According to this formula, the age of maximum yield is 7 years and 2.4 months. As similar equations have been successfully used to represent changes due to development, the author suggests that the change in milk yield depending on age is due to the growth of the udder.

V AND VI. — These two articles are respectively summarised in *Bulletin* 286 (see § IV) and in *Bulletin* 284 (see § III).

VII. — ON THE INFLUENCE OF AGE ON MILK YIELD AND BUTTER-FAT PERCENTAGE AS DETERMINED BY THE 365 DAYS RECORDS OF HOLSTEIN-FRISIAN CATTLE. — The author has studied, by the help of the statistical method, the annual milk yield of 2586 cows ascertained for the Holstein-Frisian Advanced Registry. From the data thus obtained he plotted a curve showing the correlation between milk yield and age which may be expressed by the following formula :

$$y = 11351.5 + 873.07 x - 32.225 x^2 + 1548.36 \log. 10 x.$$

where  $y$  is the number of pounds of milk produced annually, and the age, in years, at the beginning of the test is expressed by  $1.25 + 0.5 x$ .

According to this formula, the maximum amount of milk is produced at the age of 8 years, 4 months and 29 days.

The butter-fat percentage of milk seems to decrease uniformly but slightly with the age of the cow. From the data obtained a graph was plotted forming a straight line corresponding with the formula :

$$\text{Percentage of butter-fat in milk} = 3.470 - 0.09 \times \text{age of cow in years.}$$

VIII. INHERITANCE IN CROSSES OF DAIRY AND BEEF BREEDS OF CATTLE (I). — *Transmission of milk production to the first generation.* — Graphic curves are given indicating milk production (corrected so as to apply

(1) This paper is the continuation of the article summarised in *R.* April 1919, No. 488. (Ed.)



to cows of 2 years of age) and the changes taking place in this production in the case of 12 cross-bred cows. Similar data are also given for the dams of these cows and for the potential, assumed milk producing capacity of their sires. These corrections were made according to the methods described in *Bulletin* 293. The author takes the mean milk production of the pure-breed cows as the hypothetical and potential milk production of the bull siring them. The cross-bred cows were: 3 Angus × Guernsey; 2 Jersey × Angus; 2 Jersey × Holstein; 2 Holstein × Guernsey; 1 Angus × Jersey; 1 Angus × Ayrshire; 1 Holstein × Angus. Their production was more or less the same as that of the sire with the highest production. Hence we may conclude that the character of high milk production is incompletely dominant.

*Transmission of butter-fat content of milk to the first generation.* Graphic curves shew the corrected percentages of the fat content of the milk given by the above-mentioned 12 cross-bred cows. The percentage of the milk produced by their dams and the hypothetical potential percentage for their sires are calculated by a method similar to that employed in estimating the hypothetical milk production. As a rule, the butter-fat percentage had a tendency to resemble that of the parent with the lowest butter-fat percentage. There was no sign of this character being sex-linked.

IX. ANIMAL HUSBANDRY INVESTIGATIONS CARRIED OUT IN 1920 AT THE MAINE EXPERIMENT STATION. — This is a report of work that has been summarised in *R.* April 1922, No. 455 (III) (1) and of data published in *Bulletin* 295 and summarised above. It further contains preliminary information regarding other kindred subjects, mostly relating to the physiology of milk production.

In the case of the Holstein-Frisian cows, a comparative study was made of the milk production for 7 days and 365 days respectively. It was found that the first was of great assistance in determining the value of a cow though the second was a more certain criterion of her future performance.

The author states that as milk production and the fat-content of milk vary with the age of the cow, the fat-content should be taken more into account than is done at present when entering cows in the Herd-book. The maximum butter-fat content is found in the milk of cows of about 8 years of age, whereas for admission to the Advanced Registry, the percentage required does not increase for animals above 5 years old. Generally, the conditions of admission are hardest for the youngest cows.

The study of twin births as shown by the Herd-books of the Holstein, Jersey, Guernsey, Shorthorn and Angus breeds in the United States, show that the sires of twin calves are generally younger than the sires of single calves, whereas the dams of twins are usually older than the cows dropping single calves.

The author has finished a study of the milk production of Holstein-Frisian bulls similar to previous studies relating to Guernsey and Jersey

(1) See also *R.* Oct. 1920, No. 1012. (*Ed.*)

cattle He states that the sire of cows with a milk production superior to that of their dams may be slightly more in-bred than the generality of bulls In any case, these results show that in-breeding, such as is usually practised in the case of the United States Holstein-Frisian breed, has no injurious effect so far as milk production is concerned

A Table gives the percentages of butter-fat and of total dry matter in the milk of the various breeds of cattle (1) F. D.

611 - The Period of Lactation as a Factor in the Variation of the Percentage of Fat in Cow's Milk (2). — RAGSDALE A C and TURNER, C W (University of Missouri), in *The Journal of Dairy Science*, Vol V, No 1, pp 22-26, 1 diagram, bibliography, of 6 works Baltimore, January 1922

A connection has often been observed between the period of lactation and the fat content of the milk The authors recall the results of the experiments made on this subject by PINGREE, VAN SLYKE, ECKLES and SHAW, THORNDIKE, and GRLDY (3) and give the results they themselves

(1) See *R* June 1920, No 670 (1d)

(2) Other important studies on the factors affecting the composition of milk, which were also made at the Missouri Experiment Station, are summarised in *R* April 1917, No 347, *R* July 1917, No 651 and *A* April 1918 No 445 *Bulletin* 151 (1917) and *Bulletin* 163 (1919) of this Station published in addition to an account of experiments on the effect produced upon the lactic secretion by the by products of cotton seed (summarised from another source in *R* July 1917 No 651), a description of experiments dealing with 1) the cause of the decrease in the fat of milk due to feeding maize silage with cotton seed cake to cows 2) the effect of the condition of the cow at the time of calving upon the composition of the milk and its fat content The authors (C H ICKLES, L S PARMER, and W W SPRUE) stated that this depressing effect of silaged forage is due to its lactic acid content the same effect was also produced by lucerne hay damped with a solution of lactic acid equivalent to the amount given with maize silage

The last part of the work deals with a cow that was under fed during its second year It yielded milk with about 3% of protein and a little under 3% of fat, the saponification and Reichert-Meissl indices were high and the iodine index was low After 90 days of lactation, the protein in the cow's daily ration was increased from a little over 400 gm to 900 gm approximately This caused a distinct improvement in the animal's physical condition, its live weight increased by some kg as did also the daily milk yield The protein content of the milk rose to 3.5% and the fat content to 5% the character of this fat was normal

In *Bulletin* 163, the same authors study the effect that the condition of the cow at the time of calving exerts upon the composition of the milk and of its fat content When the animal calved in August 1917 it weighed 11 kg more than in the preceding year, and the composition of its milk immediately after calving was quite normal During the two months the cow was fed a ration containing a minimum proportion of protein, the protein and fat percentages were lower than those previously observed The responses to changes in the amount of protein ingested were similar to those noticed in 1916 1917 (Fd)

(3) PINGREE (1916) concludes from a study of the milk yield of 18 cows entered on the Guernsey Advanced Register that the fat content of milk tends to rise during the whole lactation period, but that the increase is more marked during the first 5 months and the last month of lactation VAN SLYKE (1908) states that the fat and protein percentages decrease in the 2nd month of lactation as compared with the first, and then rise steadily until the end of the lactation period, the greatest increase taking place during the 11th and 12th months

obtained from the examination of 3763 samples of milk entered on the Guernsey Advanced Register, 299 entered on the Jersey Register of Merit and 95 entered on the Holstein Advanced Register. The summary of the

*Effect of the period of lactation on the fat percentage of cow's milk.*

Month of lactation	Guernsey	Jersey	Holstein
	Fat percentage	Fat percentage	Fat percentage
	%	%	%
1st . . . . .	4.63	4.98	3.24
2nd . . . . .	4.59	4.82	3.01
3rd . . . . .	4.71	4.88	2.99
4th . . . . .	4.85	5.10	3.02
5th . . . . .	4.97	5.13	3.01
6th . . . . .	5.08	5.26	3.08
7th . . . . .	5.16	5.40	3.11
8th . . . . .	5.22	5.43	3.16
9th . . . . .	5.29	5.50	3.19
10th . . . . .	5.39	5.58	3.27
11th . . . . .	5.49	5.60	3.32
12th . . . . .	5.60	5.73	3.49

results are given in the annexed Table. From them it is seen that under ordinary breeding conditions, and independently of the season and diet, the period of lactation has a distinct effect upon the fat percentage of cows' milk. This percentage decreases considerably from the first to the second month and in certain cases this diminution continues, though to a less marked extent, during three months at least. Later, the fat content gradually increase again, especially during the last month of lactation.

F. O

612 - **Butter Production Records for the different Breeds of Milch Cows in Kansas.** — FITCH, G. B., in *Agricultural Experiment Station, Kansas State Agricultural College, Manhattan, Circular 90*, pp. 32, figs. 13. Manhattan, 1921.

The author gives a short account of the breeding of milch cows in Kansas (935 000 in 1920), and the rules followed by the breeders, especially as regards choice of animals, rations and testing of milk yields. The

A summary of the work of ECCLES and SHAW (1913) is given in R. April 1913, No. 391. According to THORNDIKE (1918), the composition of milk during the different months of lactation tends to deviate from the general average for the whole lactation (brought up to 100), in the following manner: first months 89.6; second, 90.3; third 92.4; fourth 96.5; fifth 97.9, sixth 101.2; seventh 103.2; eighth 103; ninth 104.3; tenth 104.9; eleventh 105.3; twelfth 109.4. GRADY (1917) employed 10 Jerseys and 10 Holsteins in his study of the effect of the period of lactation on milk yield and butter production and on the percentage of fat in the milk. He found that the fat content of milk varies very little during the first four months of lactation, but increases gradually at a later period. (*Ed.*)

cows bred are Jerseys, Guernseys, Ayrshires, Holsteins (Dutch), Brown Swiss and Dairy Shorthorns. The following Table gives their milk yield and butter production for one year

Breed	Name of cow	Milk	Amount of fat in milk	Butter
		kg	%	kg
Holstein	Bella Pontiac	13 150	4.31	568
Guernsey .	Countess Prue	8 449	5.92	500
Jersey .	Plain Mary .	6 920	6.82	472
Ayrshire .	Lily of Willowmoor	12 517	4.23	433
Brown Swiss .	College Bravura 2nd	8 827	4.10	362

F D

## SHEEP

613 — **The Herdwick Sheep, a good Breed for poor Mountain Lands.** — REID, E., in *The Journal of the Ministry of Agriculture*, Vol XXVIII, No 6, pp 501 505, London 1921

The author calls attention to the good qualities of this small but very hardy breed of sheep reared exclusively in the fell districts of Cumberland, Westmorland and Lancashire. He describes the animals, gives an account of the methods of breeding them and of their yield and finally discusses the question of their origin, which is probably Scandinavian.

At birth the lambs have a black head, legs and shoulders, the rest of the body being white. Later the dark parts become light grey. The ewes are hornless and a small percentage of the rams either have no horns, or they are rudimentary, 4.5 % in the 570 rams examined by the author.

The instinct which induces these sheep to return, even from very long distances, to the place of their birth and rearing, allows them to be kept in unenclosed fields, where they spend all, or most of the year. Lambing takes place before the end of April, 80 lambs per 100 sheep is regarded as fair, 90 as good, while a proportion of 10 % of twin births is highly satisfactory.

As a rule, the best ewes are kept for the production of pure-bred lambs, but where some extent of valley bottom is available, a certain number of these ewes are crossed with Leicester or Wensleydale rams in order to obtain grey-faced lambs. The Leicester hybrids mature earlier, and the Wensleydale are longer-sided. These lambs are sold to the shepherds of the plain.

The average weight of the carcass of an adult Herdwick ewe is about 5.5 kg. The mutton, especially in the case of four-year-old sheep, is of superior quality to that produced by any other English breed. The wool is coarse, and can be used for making carpets. An average fleece weighs about 4 kg.

All attempts at crossing Herdwick sheep with other breeds, with a

view to improving their wool or increasing their weight, have failed and the hardiness of the breed has to a great extent been lost in the process  
F D

**614 - Intensive Feeding of Ewes at Lambing Time and other Means of increasing the Production of Lambs.** — MARSHALL, F R., and POTTS, C G., in *United States Department of Agriculture, Bulletin No 969*, 14 pp Washington, 1921

Flushing, or the intensive feeding of ewes at lambing time, as a means of increasing the number of births and the production of twins has been tried for 5 years on a total of 302 ewes mated on the farm of the Bureau of Animal Industry at Beltsville, Maryland, and on the United States Morgan Horse Farm, at Middleburg, Vermont. On an average, 125 ewes that had not been subjected to intensive feeding produced 128.8 % lambs as against the 146.9 % dropped by 177 ewes that had been flushed. The first lot was put out to grass and given no ration, the second was grazed on richer meadows or else given a supplementary ration consisting respectively of oats, maize + oats, maize + oats + linseed-meal cake (14 5 1), or of maize + oats + linseed-meal cake + bran (4 4 2 1), at the rate of 225 to 340 gm per head and per day. The ewes were pure-bred Southdowns. The results of these experiments confirm the opinion that the number of births depends upon the age of the ewe. In the case of ewes from 2 to 9 years old at the time of lambing, the births were respectively 111.4 — 123.8 — 143.3 — 143.5 — 161.2 — 142.8 — 113.6 — 162.5 %. The number of twins depended on the breed, as is seen by the following data for 1919 to 1920 supplied by the Animal Husbandry Division of the Department of Agriculture of the United States

*Percentage of births in the case of sheep of different breeds  
(Average of 189 flocks)*

Breed	Two-year old ewes	Older ewes	Total number of ewes
Dorset . . . . .	146	163	158
Lincoln . . . . .	145	161	157
Oxford . . . . .	144	156	152
Southdown . . . . .	143	153	151
Hampshire . . . . .	139	148	144
Cotswold . . . . .	135	148	144
Shropshire . . . . .	134	154	149
Tunisian . . . . .	123	149	141
Rambouillet . . . . .	111	125	122

No correlation was observed between the age of the ram at the time of service and the number of twin births. The fact that the parents were not themselves twins appears to make no difference to the number of twins produced by them.

If both the twin lambs are suckled by their dam, they do not attain

the weight of the single lambs, but if each is reared by a separate ewe, they become as heavy or even heavier than the single lambs.

The average weight of ram and ewe lambs at the age of 6 months is 35.7 kg. per head; twin lambs suckled by the same ewe weigh 34.2 kg. and twin lambs each suckled by a different ewe, weigh 36.3 kg.

The largest percentage of twin births is met with in the case of the ewes which are in heat and mated soonest.

In order to produce the greatest number of twins, the ewes showed an increase in weight of at least 3 kg. during the service period.

When full-grown, there is little difference in the size of the young sheep whether twins or not

F. D.

FIGS

615 - **The Improved German Pig as a Means of improving Swine in the Province of Gorizia, Italy.** — ALDRIGHETTI, F., in *Bollettino Agrario, Organo dell'Ufficio provinciale e dei Consorzi agrari della Provincia di Gorizia*, Year III, No. 37, pp. 3-4, Gorizia, April 1, 1922

The improved German pig ("deutsches veredeltes Landschwein"), is characterised by its large size, thrift, early maturity, the fine quality of its meat, and its resistance to disease, this latter quality rendering it superior to other more susceptible breeds, such as the Yorkshire. It has been imported into the Province of Gorizia where animals of great weight have been bred, one German sow reared in the province weighed 3 quintals at the age of eighteen months, while another turned the scale at 4.5 quintals when 2 years old. Crossed with the Friulian breed, which is also reared in Gorizia, it produces offspring with such fixed characters that they can justly bear the breed-name and be called "Improved German Pigs." During the War, Gorizia not only lost 20,000 swine, but the quality of the remaining animals greatly deteriorated, for this reason, the author advises the introduction of new blood by means of importing from Germany boars and sows for breeding purposes.

F. D.

616 - **The Influence of Age upon the Fertility of Sows (1).** — J. L. LINGG, T., in *Proceedings of the National Academy of Sciences of the United States of America*, Vol. VII, No. 5, pp. 134-138, bibliography of 16 works. Washington, 1921

The author carried out experiments in Denmark on 134 sows of the Danish breed and the results were communicated by PEARL to the National Academy of Sciences of the United States. Information as to their last 10 farrows was obtained from entries in the Danish Herdbook, Vols V and VI. All the sows bred and kept in breeding centres under State control under similar conditions, farrowed for the first time when about a year old and produced without any regard to the season, 2  $\frac{1}{4}$  litters annually. Thus, the successive litters should be in strict correlation with the age of the sows.

It seemed advisable to consider the number of young in each farrow,

(1) See R. July 1921, No. 744. (Fd.)

*Real and theoretical number of young per farrow for 10 successive farrows.*

Farrow		Average number of young per farrow (found)	Average number of young per farrow (calculated)
I		II	III
No 1 . . . . .		9.45	9.25
» 2 . . . . .		10.01	10.42
» 3 . . . . .		11.50	11.24
» 4 . . . . .		12.01	11.81
» 5 . . . . .		11.99	12.19
» 6 . . . . .		12.16	12.38
» 7 . . . . .		12.13	12.39
» 8 . . . . .		12.34	12.24
» 9 . . . . .		11.90	11.92
» 10 . . . . .		11.66	11.43
Averages. . . . .		11.52	11.53

which was 11.5 for the 10 successive litters of the 134 sows. The breed is thus very prolific.

By using MINER'S method (1), the author obtained with the help of the data given in this Table, the relation between fertility and age. The general form of the equation is  $y = a + bx + cx^2 + d \log. x$ , in which  $y$  represents the number of animals in the litter, and  $x$  the number of the farrow.

In the case in question, the equation is as follows :

$$y = 8.414 + 0.915x - 0.078x^2 + 1.627 \log. x.$$

The theoretic mean of the number of piglings in the successive litters is obtained by solving the equation and attributing successively to  $x$  the values 1-10. These values are given in column III of the Table.

Taking  $\frac{dy}{dx} = 0$  and finding the value of  $x$ , the largest litter is seen to be 6.56.

F. D.

617 - **Oats as a Pig Feed.** — PERKINS, A. J., in *Journal of Agriculture*, Vol. XXV, No. 5, p. 430. Adelaide, December 15, 1921.

The question whether oats should be fed to pigs depends entirely upon the difference in price between this oats and other pig-feeds, for physiologically it is well suited to pigs, although it is seldom given to them.

Oats ought not, however, to be the sole ration given to the animals, except perhaps in the case of old sows that are to be fattened. When fed to young pigs, they should be mixed with a protein food or combined

(1) MINER, J. R., Plotting Logarithmic Curves by the Method of Moments, in *Journal of Agricultural Research*, Vol. 3. Washington, 1915. (Author's note)

with grazing on leguminosae. The author, who is a Director of Agriculture, recommends the following rations for swine of different ages and sizes.

*For pigs weighing 18 kg.*: 1st ration, crushed oats 900 gm. + skim milk 1130 gm.; 2nd ration, crushed oats 900 gm + Abattoir's pig meal 110 gm.

*For pigs weighing 36 kg* · double the first and the second ration.

If oats are given alone, which is not so advisable, 1 to 2 kg should be fed daily, according to the size of the animals. The oats ought to be crushed, or preferably, covered with as much boiling water as they can absorb and left to soak for one night. They should be given in three meals. The above quantities are for grain of good quality, in the case of inferior qualities, the quantity must be increased in proportion.

*For pigs to be fattened weighing 54 kg.* · oats 2 25 kg + skim milk 3.6 kg.; or else oats 2 25 kg + tankage 0 340 kg

If oats are merely given to supplement grazing, 3 to 4 kg are fed per day, or else as large a quantity as the pig can assimilate, the latter being preferable

F. D.

#### POULTRY

618 — **Four new Breeds of Fowls.** — I New Breeds seen at the Palace, in *The National Poultry Journal*, Vol II, No 77, p 322 Westminster, November 25, 1921 — II *La Revue avicole*, Year 32, No 2, p 50 Paris, February 1, 1922

At the last Poultry Show held at the Crystal Palace, London, in November 1921, four new breeds of fowls were entered that had never yet appeared at any Show in Europe 1) Black Marias, 2) Jersey Black Giants; 3) Marsh Daisies, 4) Australian Black Orpingtons. Their chief characters were as follows.

*Black Marias* — Shape intermediate between that of the Plymouth Rock and Rhode Island fowl. Single comb, black legs. The hens have black plumage and a hackle with silver-grey markings. The cocks have a black breast, but their necks and backs are silver grey. This breed was obtained in England and is recommended by the breeder for its relatively high general qualities.

*Jersey Black Giants* — This breed comes from the United States. The birds resemble Black Orpingtons, but are less compact, with a heavy frame and large head. The hens are too large to be good layers and seem chiefly adapted to the table.

*Marsh Daisies* — A small breed, slightly larger than the Buttercup or the Sicilian "Bottone d'Oro". Two varieties are to be recognised in future, the Wheaten and the Buff; thus they only differ in colour. This breed does not yet appear to be really fixed.

*Australian Black Orpington.* — A smaller bird than the Orpington and lacking the fine plumage which makes the Orpington such a conspicuous exhibit. The new breed recalls the primitive type of Black Orpington obtained by William Cook. It therefore deserves the attention of poultry breeders who are chiefly concerned with the utilitarian point of view.

F. D.



619 - **The Croad Langshan Breed of Fowl.** — HEAP, A. J. (Bittams Experimental Farm), in *The National Poultry Journal*, Vol. II, No 54, p 22 Westminster, 1921.

The Croad Langshan fowl, which is well-known for its hardiness and table qualities, is occasionally entered at Shows and sometimes appears in laying competitions. This is due to the fact that certain families have been carefully selected by clever breeders, but the bird has never been a general favourite, or widely kept. Its weak point is that it matures slowly. Although it may be said that the hens generally lay about the ninth month, there is great individual variation in this respect which makes it possible to select for quicker maturity. Indeed, Miss SIMMONS, who is engaged in breeding Croad Langshans, has obtained hens that begin laying at 4 ½ months to 6 months, that is to say, even too early, as a pullet is not sufficiently developed at 4 ½ months. The author has also begun selection experiments with this fine breed.

620 - **The Treatment of Contagious Entero-Hepatitis in Turkeys (1) with Ipecacuanha.** — BISSET, N (Midland Agricultural and Dairy College), in *The National Poultry Journal*, Vol II, No 92, p 534 Westminster, March 1, 1922.

The author reports the good results obtained in treating a flock of turkeys suffering from contagious entero-hepatitis, with ipecacuanha as advised by Dr. H. M. WEGFORTH and Dr. PAUL WEGFORTH of San Diego (California) (2). The healthy birds are at once separated from the diseased birds, the which are given 10 drops per head of fluid extract of ipecacuanha, 3 times a day for 3 days, then twice a day for 3 more days, and finally once a day for 3 days. Turkeys which were in good health, but had been in contact with infected birds, were given powdered ipecacuanha, the dose being 1 teaspoonful for every 20 turkeys, given in their food, until the flock showed no further symptoms of disease.

The treatment was completed by the thorough cleansing and disinfection of the poultry-house. F. D.

621 - **Inheritance of Silky Plumage in Fowls. Historic Account and Description of the Sporadic Appearance of Individuals with Silky Plumage among normal Birds and their genetic Relation.** — JONES, S V II in *The Journal of Heredity*. Vol XII, No 3, pp 117-128, figs 10 + tables 2 Washington, 1921

Individual fowls and breeds of poultry characterised by silky plumage have been described by ancient and modern authors amongst whom may certainly be included ALDROVANDI (1597), and perhaps, according to

(1) SMITH described this disease in 1895 under the name of contagious entero-hepatitis, later, it was studied in France by LUCET, who called it perityphlo-hepatitis. In the United States, it is known as "black head", on account of the dark colour assumed by the wart-like excrescences on the head and the wattles of infected turkeys. The disease is caused by *Amoeba meleagridis*, which passes from the intestine into the circulation and the liver, where it induces inflammation that is nearly always accompanied by intestinal inflammation. — A. PRÉSCE, *Le maladie des pouls*, pp 145-149 Milan, Hoepli, 1912. (Ed)

(2) The good results obtained with this method in California have been reported by A. SCHOFIELD, General Manager of the Poultrymen's Milling Association in California — *The National Poultry Journal*, Vol. II, No 66, p 165 London, Sept 9, 1921. (Ed)

DAVENPORT, even MARCO POLO (XIII century). BEECK (1) distinguishes 5 varieties: a) the "Siamese Silky" with red periosteum, red skin on the head, yellow beak and legs, yellowish plumage; b) the "Japanese Silky", with black skin and white plumage; c) the "Silky of Japan" with black skin; the "Chinese Silky" resembling the Siamese in the yellowish colour of its plumage, which is in reality more woolly than silky; e) the Negro Silky with black skin and plumage.

The author's review of different works, for the most part of recent date, shows that the silky plumage characterising the five above-mentioned varieties occurs sporadically in the following breeds that usually have normal feathering: *Cochin*, *Bantam Cochin*, *Rhode Island Red*, *Black Orpington*, *White Rock*, *White Wyandotte*, *Brown Leghorn*, *Grey Brahma*, and *Black Langshan*. No systematic studies have so far been made respecting the genetic behaviour of the plumage of these individuals, but many experiments have been carried out in crossing pure-bred silky individuals and individuals with normal plumage. The results of all these experiments show that silky feathering is recessive and occurs in the simple Mendelian ratio, as regards normal plumage.

The author, having by chance come into possession (1917) of a Brown Leghorn hen (referred to as 1A), with characteristic silky plumage, crossed this bird with a pure-bred White Leghorn cock. In the  $F_1$  generation only 3 individuals attained maturity, one cock and two hens, all of which had normal plumage. In the  $F_2$ , one pair of birds produced 40 individuals, 29 with normal plumage and 11 with silky plumage (theoretical ratio 30:10), while the other pair had only 5 offspring all with normal plumage. The total of 34 normal individuals and 11 silky gives a ratio very near to the theoretic ratio, of 33.75:11.25. In a similar manner, on mating the head fowl of the strain with the only cock of the  $F_1$ , the author obtained 5 normal and 6 silky individuals, equal numbers being expected theoretically. Thus, silky plumage that arises sporadically behaves as a simple Mendelian recessive.

In order to decide whether the sporadic appearance of birds with silky plumage was due to the same factor as that causing silky feathering in the pure breed, the author also made reciprocal crosses between pure Silkies and pure White Leghorns, as well as between the  $F_1$  individuals of these crosses with the  $F_1$  and  $F_2$  individuals resulting from the cross between hen 1A and the White Leghorn cock. The results proved that the character of silky in 1A is genetically the same as in the pure Silky fowl.

Silky plumage has been met with sporadically amongst domestic fowls for many centuries and perhaps dates back to the beginning of their domestication. It is probable therefore that this type of feathering appeared accidentally in the wild ancestors of the domestic fowl and that this character behaves in the same manner in the present wild breeds. It is impossible

(1) BEECK, *Die Federvuchsucht als Wirtschaftsweg und Liebhabererei*, vol. I. Verlag von R. Schmidt, 1908, pp. XIII-1880. (Authors' note)

to determine whether the sporadic cases are due to independent mutation, or are all produced by a single primitive mutation that has been transmitted through successive generations and through the present different varieties.

E. F.

622 - **The respective Influences of Cock and Hen in Egg Production.** — KAUPP, B. F. (North Carolina Experiment Station), in *The National Poultry Journal*, Vol. II, No. 74, p. 279-280. London, November 4, 1921.

Since 1914, the author and his collaborators have been occupied in the selection of poultry with a view to obtaining large egg production. They always used similar poultry-houses, of modern type with open front and tiled roof, and fed the birds on the same food; the only different factor for all the successive generations was the genetic.

**MATING OF ORDINARY FOWLS WITH ORDINARY COCKS** — The initial flock (No. 1), consisted of 90 hens of one year of age, the average number of eggs laid annually during 3 years was 80. On being mated with one-year-old cocks, they produced flock No. 2. No selection had been made in the case of either sex, all the birds were reared without exception, both with the object of studying individual variations, and in order that the conditions should be those obtaining in ordinary poultry-rearing.

In flock No. 1, only 8 hens each laid over 100 eggs during the 3 years of the experiment; only one laid 150, the second place was taken by a hen laying 128.

Flock No. 2, composed of unselected cocks and hens, produced an average of 88 eggs per fowl annually when the birds were in their second year, the three-years average per hen was 92 eggs.

The best layer gave 180 eggs and the second best 154; only two hens laid 150 eggs or more during one of the 3 years.

**MATING ORDINARY HENS WITH SELECTED COCKS** — The second year, the hens of flock No. 1 were mated with 3 cocks (brothers), the performance of their ancestors being as follows: mother laid 207 eggs annually; paternal grandmother 229 eggs, maternal grandmother 175 eggs; pedigree of grandparents unknown (selected during 3 generations). In this way was flock No. 3, obtained was composed of 100 fowls of which 96 had completed their first year. The three years' average of eggs per hen was 135, that is to say, 46 hens, or 48 %, laid 150 eggs or more in a year, and 5 laid 200 or over. It is thus clear that their laying capacity was transmitted by the cock.

**TRANSMISSION OF FERTILITY FROM GRANDFATHER TO FATHER AND FROM FATHER TO DAUGHTER** — Flock No. 4, was obtained by mating flock No. 2, with 3 cocks (brothers). The father of these 3 cocks is one of the three birds whose ancestors' performance is given above; their mother had laid 128 eggs a year. The hens of flock No. 2, like their mothers were not good layers, their three years average being only 92 eggs. The increased fertility of flock No. 4 was therefore undoubtedly due to the influence of the father and the paternal grand-father. During two years of laying, flock No. 4 produced an average of 138 eggs per hen and per year;

the best layer, a hen obtained after 6 years selection, belonged to this flock. This hen laid 232 eggs in one year; 23 hens, or 56 %, laid 150 eggs or over; 11, or 27 % laid 175, and 4 laid over 200 eggs in one year.

**MATING SELECTED HENS WITH SELECTED COCKS.** — Flock No. 5 was obtained by mating the 12 best layers of flock No. 3 with a cock whose paternal grandmother laid 242 eggs annually, his maternal grandmother laying 234. The 12 hens of this flock laid 6129 eggs in 3 years, or 510 each in 3 years, and 170 per hen and per year. The three years' average of the best layer was 223 eggs

Of the hens composing flock No. 5, 46 laid on an average 162.2 eggs; 28, or 60 % 150 or more eggs; 15, or 32 %, laid 175 or more eggs.

*Results obtained in 6 years.*

Ordinary hens (unselected white Leghorns) . . . . .	89 eggs annually
Progeny of ordinary hens × ordinary cocks . . . . .	96 " "
Progeny of ordinary hens × selected cocks . . . . .	135 " "
Progeny of ordinary hens × sons of selected cocks . . . . .	138 " "
Progeny of selected hens × selected cocks . . . . .	163 " "

The capacity of laying a large number of eggs is thus transmitted from mother to son and through the latter to his male and female offspring alike.

If the hens do not belong to a good breed, a large production of eggs is not to be expected, no matter how much attention is given to the feeding of the birds, or the hygiene of the poultry-house, etc; on the other hand if the breed is good, success depends upon observing carefully the rules for rearing and keeping domestic poultry. F. D.

623 - **The Dryden Method of choosing Laying Hens.** — *The National Poultry Journal* Vol II, No 56, p 42 Westminster, 1921

Prof JAMES DRYDEN has devised a method for the classification of hens as good, fair and bad layers. This method is based on the egg production ascertained by the use of trap-nests and by the study of the characters of the fowl.

Hens that cease laying and moult in July-August are not good layers, the same may be said of pullets laying few eggs their first year; such birds will not improve later and are therefore better eliminated.

Should nest-traps not be available, omission of laying is shown by: 1) shrivelling of the comb, wattles and auricles; 2) the narrow pelvis; 3) the contraction or induration of the abdomen; 4) in breeds having naturally yellow skin and legs, like the Leghorns and Plymouth Rocks, the brilliant hue of the legs and beak show that the hen has not laid for some weeks; 5) moulting.

In July, August and the beginning of September all fowls should be weeded out that: a) are in an advanced stage of moulting, the comb

and wattles being shrivelled ; *b*) have a contracted abdomen, or dry and wrinkled cloaca ; *c*) have yellow legs and beak. As a rule, symptom *a* is sufficient guide, but it is sometimes necessary to find it combined with *b*, in order to be quite certain ; *c* alone is not enough and this symptom must be associated with either *a* or *b*.

By adopting this method it is possible to reduce by 20 % a flock of average fowls without lessening the egg production.

The better the feeding and general conditions, the more certain are the results obtained, for scarcity of food or a change in diet or environment may cause laying to cease, and make even a good layer begin to moult.

If it is desired to make a still more rigorous selection and to keep only fowls able to lay 200 eggs a year, hens must be chosen, from October 15 to November 15, which have not completed moulting, and possess : 1) bright red wattles and comb, and quick eyes ; 2) very broad pelvic bones, and elastic caruncle and abdomen ; 3) pale legs, beak and cloaca, if the breed is one in which the skin and legs are naturally yellow. The present higher price of food renders the rigorous selection of the best laying hens more necessary and more profitable than before the War.

624 - **The Duck as an Egg-Layer.** — PINARD, V, *La Production des œufs de canes in La Revue avicole*, Year 32 No 5, pp 155 156 Paris, May 1, 1922 - The National Laying Test in *The National Poultry Journal* Vol II, No 99, p 639 Westminster, April 28, 1922

The value of the duck as a great egg layer capable of producing as many and even more, than the fowl, has only been clearly shown of recent years.

The results of the first egg-laying competition for ducks which took place in 1920-1921, at Bentley, England, and lasted for 48 weeks dating from October 22, are given in the following Table :

No. of ducks at begin- ning	Ducks that died	Breed	Eggs laid		Totals	Average
			size 1	size 2		
115	4	White Indian Runner	16 774	48	16 822	148.52
70	2	Brown Runner . . .	11 493	60	11 553	168.11
10	0	Magpie . . . . .	1 543	4	1 547	154.70
15	0	Buff Orpington . . . .	2 538	10	2 548	169.85
10	2	Khaki Campbell . . .	1 987	8	1 995	204.49
220	8	<i>Totals . . .</i>	34 335	130	34 465	
		Eggs laid out of nest .	229	1	230	
			34 564	131	34 695	160.24

The lot of 5 Khaki Campbell ranks first with 1211 eggs, or an average of 242. The second place was allotted to a group of brown and white

Runners with 1075 eggs. The duck that had laid most eggs (269), was a White Indian Runner. 26 ducks laid more than 200 eggs.

The Khaki Campbells take their name from a lady who bred them, at Uley, Gloucestershire. They are the result of crossing Runners, Rouens and Orpingtons. The fact that there is also Runner blood in the two latter breeds explains why both are celebrated for large egg production.

In the competition of 1921-1922, which began on October 21 and is still in progress, all the competitors belonging to the Coaley Fawn, Khaki Campbell, Orpington and White and Fawn Runner breeds laid a great number of eggs, the average being 75.73 per head for the 20 winter months.

F D

#### BFF-KFFPING

625 - **Bee-Keeping in Rhodesia** (1). — ROSS, J. W. in *The British Bee Journal* Vol. 4, No. 2072, pp. 106-107. London, 1 March 1922.

The author alludes to the prevalence of wild bees in Rhodesia and describes his successful attempts at keeping and breeding them in a systematic manner.

The native bee much resembles the black bee of Scotland, but swarms without forming a cluster. The insect is very active and is a good honey maker and defends its hive with much energy. It is, however, very aggressive and is not affected by smoke. If disturbed during the day the insect becomes furious and stings everyone in the vicinity, and in consequence bee-keeping operations can be carried out only towards sunset. No bee disease is known in Rhodesia. The importation of queen-bees, wax, etc. is prohibited by Government.

F D

626 - **Experimental Centre in the Shetland Isles for rearing the Pure-Bred, Black, Scottish Bee.** — *The British Bee Journal* Vol. XLIX, No. 2058, p. 563. London, December 1, 1921.

In view of the great difficulty in obtaining a pure breed of the native black bee, the Scottish Board of Agriculture has installed an apiary in the Shetland Isles, far from any other centre of bee-keeping. Experiments are being made there, and it is hoped that the Shetlands will in time become a breeding centre for the supply of pure-bred, vigorous queen-bees.

F D

627 - **The Melilot as Honey-Bearing Plants.** — CHAPMAN, P. W., in *The British Bee Journal*, Vol. 4, No. 2064, pp. 10-11. London, January 12, 1922.

The Melilot (*Melilotus Officinalis* with yellow flowers, *M. alba* with white flowers, and the variety recently isolated in the United States called Hubam clover, which is characterised by its extraordinary growth), are much valued as useful forage plants that will grow on any type of soil. The author has grown Hubam clover as an experiment at Wykeham Ranch, Enderby, British Columbia. This plant was sown on April 1, and on July 15 had attained the height of 1.20 m., it was at that date in full flower. Towards

(1) See R. February 1922, No. 195 (Ed.)

2) See R. April 1922, No. 415 (Fd.)

the end of September, it had grown to 2.40 m and was still in flower and loaded with seed, having experienced no bad effects from the first light frosts

The flowers were continually visited by bees F D

628 - **Bee Diseases in Michigan.** — KILTY, B H, in *Agricultural Experiment Station Michigan, Agricultural College, Special Bulletin No 107*, 16 pp, figs 5 East Lansing, 1921

This article gives a brief account, intended for the use of practical bee-keepers and the general public, of the diseases to which bees are subject and of the best means for their control. The following diseases are studied: American foulbrood due to *Bacillus larvae*; European foulbrood caused by *B. pluton*; sac-brood, an infectious disease of the larvae due to a filtrate virus; nosema disease produced by *Nosema apis*; dysentery, spring dwindling (high mortality occurring in the spring in old hives that have passed the winter under bad conditions), paralysis, Isle of Wight Disease (1) F D

629 - **The Rearing of Reindeer in Canada (2).** — WARSON, T A in *The Agricultural Gazette of Canada*, Vol IX No 2 pp 93-96 figs 2 Ottawa March-April 1922

VARIOUS  
ANIMALS

Towards the end of October 1921, a herd of some 600 Norwegian domestic reindeer, was landed at Amadnak (Baffin Island). The consignment had been sent by the Hudson Bay Reindeer Co., who intended to despatch more of these animals in order to establish reindeer depôts at various places in the territory of North Canada where they are to be reared for the butcher. Reindeer seem very suitable for breeding in large numbers in the great unproductive tracts of North Canada. They can be employed as draught animals and thus supply a need that has hitherto prevented the exploitation of these regions.

Many successful attempts have already been made in the same direction. In 1898, reindeer were introduced by the United States into the Yukon territory, and later into Alaska F D

## FARM ENGINEERING

630 - **Co-operative Societies for the Use of Machinery and Materials used in Mechanical Tillages, for the assistance of German Agriculture.** — SCHWANECKE, in *Deutsche Landw. Presse*, No 60, pp 444-445 Berlin, 30th July, 1921, No. 61 pp 452-453, Aug 3 1921, No 62, p 453, Aug 6 1921

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

Even before the war agricultural specialists agreed that the product from the soil could be increased without much effort.

In the present state of things it becomes a duty to increase production, but this will be attained by individual effort only in exceptional cases.

Table I compares the working expenses and capital required for a farm

(1) See R July 1921, No 748; R April 1922, No 463 (Ed)

(2) See R Oct 1913, No 1185, R Oct 1914, No 931 (Fd)

of 400 hectares (of which 56 % is under cereals, 18 % under root-crops, 13 % under vegetables and fodder crops, 10 % under pasture and 3 % fallow)

TABLE I. — *Working expenses and capital required for a Farm of 400 hectares in 1912-1913 and in 1920.*

	1912-1913		1920	
	marks	%	marks	%
a) <i>Working Expenses.</i>				
1. Management . . . . .	5 000	2.5	18 000	1.8
2. Wages of employees and servants . . . . .	10 200	5.1	30 600	3.1
3. Keep of draught animals . . . . .	35 500	17.8	177 500	17.8
4. Workmen's wages . . . . .	15 500	7.8	77 500	7.8
Extras for work with machines . . . . .	1 000	0.5	5 000	0.5
5. Cost of machinery . . . . .	16 800	8.5	84 000	8.4
6. Seed . . . . .	12 300	6.3	71 000	7.1
7. Chemical fertilisers . . . . .	19 400	9.7	238 000	23.9
Manure . . . . .	15 400	7.7	30 800	3.1
8. Cost of tools . . . . .	2 000	1.5	5 800	0.6
9. Cost of buildings . . . . .	1 800	0.9	3 600	0.4
10. Taxes and insurance . . . . .	4 500	2.3	13 000	1.3
11. Interest on other than stock capital . . . . .	16 450	8.2	86 200	8.7
Interest on stock capital . . . . .	35 000	17.5	70 000	7.0
12. Unforeseen expenditure . . . . .	7 250	3.7	85 000	8.5
<i>Total working expenses . . . . .</i>	<i>199,000</i>	<i>100</i>	<i>996,000</i>	<i>100</i>
<i>Expense per hectare . . . . .</i>	<i>497.50</i>	<i>—</i>	<i>2,490</i>	<i>—</i>
b) <i>Capital required.</i>				
A. — Stock capital .				
i. Estate capital .				
Land buildings . . . . .	1 072 000	81.3	2 144 000	55.7
B. — Working capital:				
i. Fixed capital:				
Live stock . . . . .	36 000	2.7	360 000	9.4
Tools and machinery . . . . .	55 800	4.2	558 000	14.5
ii. Floating capital:				
Crops left on the land, provisions. . . . .	156 200	11.8	784 000	20.4
<i>Total . . . . .</i>	<i>1 320 000</i>	<i>100.0</i>	<i>3 846 000</i>	<i>100.0</i>



for the years 1912-1913 and 1920. It shows that the greater increases in prices apply to live-stock, wages, machinery and especially artificial fertilisers.

The statistics for 1907 (Table II) on the use of machinery show that this use may be greatly extended, and except for the introduction of mechan-

1907. TABLE II. — *Agricultural machinery used in Germany based on the Official Estimate.*

Size of farms	Total number of farms in existence	Percentages of machines employed								
		Mechanical traction ploughs	Seed drills		Chaff cutters	Reap- ing ma- chines	Potatoes		Threshing machines	
			broad- cast	furrow			Plant- ers	Dig- gers	Steam	others
	<i>hectares</i>									
2	3 378 500	0.001	0.42	0.15	0.01	0.04	0.002	0.001	2.10	1.32
2-5	1 006 280	0.002	1.56	0.50	0.11	0.68	0.006	0.009	12.70	16.30
5-20	1 065 540	0.008	8.25	3.11	0.39	12.90	0.029	0.394	19.10	50.50
20-100	262 190	0.122	28.00	11.80	2.30	52.00	0.330	2.075	26.30	73.00
100-500	20 070	8.600	64.00	38.00	11.70	82.00	4.900	5.300	66.50	41.30
500-1000	3 130	22.800	78.50	47.60	13.10	87.50	10.000	4.500	90.00	21.60
1000	370	32.600	77.50	50.30	17.10	89.00	11.400	8.450	91.50	26.20
<i>Total and ave- rages . . . .</i>	<b>5,736,000</b>	<b>(0.052)</b>	<b>3.61</b>	<b>1.45</b>	<b>0.25</b>	<b>5.26</b>	<b>0.046</b>	<b>0.192</b>	<b>8.56</b>	<b>16.50</b>

ical traction ploughs, things have not improved during the war. The high price of machinery at present render its extended use very difficult. In Table III a comparison is made between the prices of machinery, coal, oil and other accessories in 1914 and 1920.

In spite of the high price of machinery, every farmer can use it extensively thanks to the cooperative society. It is especially advantageous in the case of special machinery or that used in extensive production, as, for instance, mechanical traction ploughs, threshing-machines, provincial railways, etc.

Simple machinery and that in ordinary use, such as horse-ploughs, harrows, rollers, clod-crushers, etc. may be acquired by each farmer. The other machines: fertilising, seed-drill, binders, but especially horse-ploughs, steam-threshers, live-stock weighing-machines, provincial railways, etc. will be used advantageously by co-operative societies.

The author compares the cost-price of the work done by several machines on a farm of 20 hectares and on one of 400 ha.; from which he concludes that for small farms it is necessary to co-operate for the use of machinery.

The author especially deals with co-operative societies for the use of threshing-machines and of mechanical traction ploughs. Up to the 1st January, 1919, 667 societies were registered in Germany for the use of threshing-machines and mechanical traction machinery and ploughs.

TABLE III.

Machinery and accessories	1914	1920
	marks	marks
Plough with 25 cm. fore carriage . . . . .	50.00	850.00
Steam plough with two engines, 12 HP. . . . .	56,000	590,000
Motor Plough, 50 HP. . . . .	18,000	150,000
Fertilising machine, 3,75 m. . . . .	450	5,300
Sower in furrows, 3,75 m. . . . .	800	13,000
Sower in furrows, 2,00 m. . . . .	420	5,400
Chaff cutter, 2,00 m. . . . .	245	3,100
Haymaker, 2,00 m. . . . .	200	2,900
Horse-rake, 2,4 m. . . . .	135	2,100
Reaper-binder . . . . .	950	10,000
Steam threshing-machine with press-binder, 10 HP. . . . .	14,500	22,000
Screen (with cylinder) . . . . .	400	6,500
Potato-digger . . . . .	300	3,900
Potato-screen, 30 quintals per hour . . . . .	100	1,250
Portable engine, 10 HP . . . . .	4,600	82,000
Benzol-motor, 2-3 HP . . . . .	850	10,000
Benzol-motor for plough, 50 HP . . . . .	4,800	40,000
Electric motor continuous current, 220 volts, 5 HP, 1300 revolutions, accessories . . . . .	500	12,800
Electric motor, intermittent current, 220/380 volts, 20 HP, 960 revolutions, accessories . . . . .	1,300	32,000
Pit coal, per 100 kg. . . . .	1.80	25.00
Benzol, per 100 kg. . . . .	22.00	550.00
Lubricating liquids, per 100. kg. . . . .	50.00	1 500.00
Garniture, per kg. . . . .	1.10	22.00
Driving-belts . . . . .	8.00	320.00
Electric current per HP per hour, for power . . . . .	0.18	1.35
Electric light current per HP per hour . . . . .	0.50	2.85

The threshing-societies have been established longer than the other. The steam-ploughing associations come next, their number in 1919 being 52.

Ploughing by mechanical traction, tractor, or motor-plough, has scarcely developed under the form of co-operative societies, for the first results were not very satisfactory. The author attributes this to lack of organisation and defective exploitation; and considers that the societies might succeed if established on a sound and firm basis and managed by a capable staff.

G. B.

631 - **Schmidt Tractor, specially constructed for Marshy Ground.** — *Deutsche Landw. Presse*, No 35, p. 260 Berlin, 4th May 1921

The wheels are placed inside the chassis in order to reduce its width.

Each driving-wheel is formed of two narrow discs joined by two cross pieces. Two skeleton wheels are thus formed which can also be united so as to form a single driving-wheel.

G. B.

632 - **Apparatus for extracting Oily Matter by Ethyl Trichloride.** — BONNET, J (Professor of oleoculture at Marseilles), in *Bulletin trimestriel de l'Office régional agricole du Midi*, No 1, pp 11-23. Marseilles, January 1922

The author uses non-inflammable, incombustible and inexplusive ethyl trichloride. He gives the characteristic qualities of this products and its current market price. As it is sensitive to light it should always be stored in metal receptacles underground, care being taken to cover it with a layer of water 0.25 m. to 0.40 m. to prevent evaporation.

On being brought into contact with a substance containing oil when the substance is almost dry and at a favourable temperature, the ethyl trichloride after two or three hours absorbs all the oil contained in the substance.

The mixture of oil and solvent is conveyed into an apparatus called the « distiller », into which dry, superheated steam is introduced; the trichloride distils at 85° and, after passing through a refrigerator, is collected in a receptacle intended for that purpose. When the oil has been extracted from the substance, the latter is subjected to a jet of steam which drives out the remaining solvent, all of which is thus recovered.

The oil is collected from below.

The process is simple and may be carried out by one operator.

The apparatus includes: 1) a fruit-stone crusher (2 toothed rollers); 2) a dryer; 3) a boiler of 15 to 20 sq. m. capacity to supply the steam; 4) two extractors of 500 to 600 kg. each. the substance is placed on a grating covered with a thick mesh and is fed from above; underneath is an opening for ejecting the waste substance; 5) the distiller with its accessories (levels, projectors, etc.); 6) a multiple refrigerator connected with the 2 extractors and the distiller. As soon as one of the extractors is full, the solvent is introduced; the other extractor will not be filled with solvent until the oil has been extracted from the substances in the first.

After 2 to 3 hours, fresh solvent is introduced into the first extractor. This, being denser than the mixture of oil and solvent, forces the latter into the distiller, steam is brought into action and the distiller is then emptied; it will be refilled from the extractor while the process of extraction is going on in the latter. Fresh solvent is then introduced into the first extractor and the solvent is driven into extractor No. 2; in this way, any oil still remaining in the substance cannot be lost. The solvent in contact with the exhausted substance is ejected directly into the solvent receptacle.

To recover the traces of solvent in extractor No. 1, it is connected with the boiler; the steam carries off all the trichloride remaining. At the same time, the operation already described recommences with extractor No. 2.

The apparatus (1) can extract oil from 2500 to 3000 kg. of matter per day, the loss of solvent being 15 litres per 3000 kg. 2 HP are necessary for the solvent pump, the crusher and the dryer. The apparatus is strongly put together and can be placed anywhere. It may be used equally well for extracting oil from olive-stones as from grape-seeds. In the latter case a seed crusher is necessary.

P. C

(1) See also R Sept. 1916, No, 1006. (Ed.)

## AGRICULTURAL INDUSTRIES .

INDUSTRIES  
DEPENDING  
ON PLANTS  
PRODUCTS

633 - **Relation between the Nitrogenous Substances in Barley and the Value of Barley in Brewing.** — HULTON, H. E., in *The Institute of Brewing, Research Scheme*, v XXVIII, supp to No 1, pp 33-112, Bibliography London, 1922.

Critical review of the scientific literature extant on the question of the nitrogenous substances in barley as related to its value in brewing from the following points of view :

- 1) Connection between the percentage of nitrogen and the size of the grain ;
- 2) Connection between this percentage and the quantity of extract of malt ;
- 3) Connection between this percentage and the nature of the extract of malt ;
- 4) To what extent is the presence of nitrogenous matter in barley connected with the properties of this cereal for brewing ?
- 5) Up to what point is the nature of nitrogenous matter related to the value of barley as raw material used in brewing ?

In summarising the results arrived at in this review, the following points become evident

*Factors which contribute to the production of barley containing a high percentage of nitrogen* ripening too quickly or too slowly ; warm, dry season ; sowing too thinly, resulting in insufficient root competition soil too rich or heavy ; excessive use of nitrogenous fertilisers, separate or mixed ; large, heavy grain ; genetic character of richness in nitrogen. Some of these factors may be eliminated, others, such as those dependent on the weather, for instance, cannot be avoided.

*Properties usually inherent in barley containing a high percentage of nitrogen.* abundant shoots ; small quantity of extract of malt ; defective ripening ; grain hard ; weight per volume low ; tendency to heating and heavy loss during malting ; slowness in malting ; high percentage of nitrogen in the malt produced high percentage of non-coagulating proteins in the must ; tendency of the beer after brewing to be cloudy ; tendency to permanent froth on the beer ; low proportion of grain as compared with straw.

All these characteristics, are, generally speaking, undesirable, and might justify one in taking as a criterion, the nitrogen content of barley when estimating its value, and this rather from the malster's than the brewer's point of view. But the method to be followed in cultivation is that of selection after determining

- 1) The desirable qualities in barley for malting and brewing ;
- 2) which among these qualities are definitely mendelian, so as to permit of selection by means of pure growths and by crossing.

In any case, all research on this subject should be directed towards quantity of output

G. A. B.

634 - **Utilisation of Tobacco Waste in the Manufacture of Nicotine Extracts and for Fertilising Purposes. Experiments in South Africa.** — SMIT, [B J, in *Journal of the Department of Agriculture, Union of South Africa*, Vol IV, No 3, pp 267-271. Pretoria, March 1922

At the present time, tobacco growers in South Africa are much concerned with the profitable disposal of their crops and have consequently turned their attention to the question of the utilisation of tobacco waste i. e. tobacco unsuitable for pipe and cigarette.

The author has made a series of detailed analyses of 36 samples of tobacco obtained from different localities, and the tables demonstrate the percentages of nicotine content and fertiliser constituents covering a wide range, also the quantity of tobacco required per gallon of extract and the value of the fertilisers per ton.

The analysis shows that the nicotine content in the air-dried samples varies from 0.41 % (lowest grade Vredefort) to 5.98 % (strong good leaf Nelspruit), with an average value for the 36 samples of 2.52 %, and from the fertilising standpoint, the potash content varies from 0.15 to 7.36 % (light Vredefort leaf) light strength, average 4.66 % 2nd crop Piet Retief

From the analyses taken as a whole the following interesting deductions have been made

One gallon of tobacco extract with specific gravity 1.35 weighs 13.5 lb and contains 1.08 lb nicotine. In order to obtain say 1.08 lb from a sample containing 2.20 % nicotine, 49.09 lb of tobacco will be required and at 3d a lb the cost of tobacco will be 12s 3d. The cost of extraction increases as the nicotine content of the tobacco decreases. For instance with extract containing 7 1/2 % nicotine, retailed at from 26s. 6d. to 28s. 6d. per gallon the cost of tobacco varied from 2s. 5d., (requiring 38.3 lb. per gall. of extract) to as much as 48s. 6d. (requiring 77.1 lb. per gall.) This calculation is based on the assumption that all the nicotine in the tobacco is removed, although in practice, allowance should be made for the small quantity which probably remains in the leaves.

With regard to the fertilising value of tobacco waste, it is considered that this material should prove to be of excellent value to such crops as potatoes, the potash content is exceptionally high. It will be necessary, however, to establish a new process of extract manufacture, as at present the extraction of the nicotine with hot water, results in the removal of most of the fertiliser constituents and the residue has little value. It should be considered, however, that the tobacco plant removes comparatively large amounts of plant nutrients from the soil (100 lb. potash, 50 lb. nitrogen and 6 lb. phosphoric oxide), and whenever possible, therefore, it is distinctly advisable to utilise the tobacco offal on the land. The analyses of the samples taken show the advantage attached to this proceeding and an economically sound solution as to the extraction of nicotine without detriment to the plant constituents would undoubtedly prove of great benefit to tobacco growers. An analysis was made of a sample of tobacco before and after extraction by the present hot water method, and the loss is striking viz. potash 93.3 %, phosphoric oxide 53.6 and nitrogen 20.3 %.

It would certainly be unwise to grow the plant solely for use as a fertiliser, but the information furnished with regard to the evident value attached to the offal, combined with the analyses recorded, throw light on a question having an important bearing on the industry. M. L. V.

635 - **Some Factors affecting the Quality of ripe Olives sterilised at high Temperatures.** — CRUESS, W. V., in *College of Agriculture Agricultural Experiment Station, Berkeley, California, Bulletin No. 333*, pp. 221-230, figs. 2. Berkeley, Oct. 1921.

At the beginning of the olive canning season in California (1920-21) it was found that the olives had become softened and had acquired a disagreeable scorched flavour as a result of sterilisation at 240-250° F. There was a distinct variation in behaviour in different cases. The investigations reported were undertaken in an attempt to determine the causes of the observed differences and extended over two canning seasons.

From the experiments conducted, it was concluded that the development of scorched flavour, bitter almond odour, and excessive softening was due to a certain extent to insufficient lye treatment or excess alkali in the fruit. It was found, however, that properly pickled olives retain their superior qualities when sterilised at 240° F for 60 minutes. The California State Board of Health has recently inaugurated a regulation demanding that this method be adopted. Rapid chilling of the can and contents to room temperature immediately after sterilisation is considered desirable in order to prevent prolonged action of the heat. On the other hand about 10 % of the fruit softened to a marked degree when heated at 250° F for 40-60 min. and to 240° F for 60 min., and olives heated to 250° F for 15, 30, 40 and 60 min. and to 240° F for 30-60 min. had a marked scorched flavour. However, after one month's storage the scorched flavour appeared to be greatly diminished.

The Manzanillo olive especially when very ripe was more subject to damage in flavour and texture at 240° F than the Mission, Sevillano and Ascolano varieties. Brine of 5 % salt (20° salometer) is recommended for shipment purposes, and one of 10 % salt (40° salometer) for conservation in the factory for long periods. Long storage in dilute brine should be avoided, although it appears that storage in strong brine for several days followed by canning in very dilute brine or water, makes the texture of the fruit more resistant.

Olives retained their colour more satisfactorily in lacquered cans than in plain tin cans which had a distinct tendency to bleach the fruit.

Acidification of the brines is not advised as it causes more serious changes in the quality than occur when the non-acidified pickled fruit is sterilised at 240° F for 60 minutes. M. L. V.

636 - **Rubber Latex for Paper Making.** — KAYE, I. (College of Technology, Manchester) in *The Rubber Age*, Vol. II, No. 9, p. 465, and Vol. III, No. 2, pp. 67-68. London, Nov. 1921, and April 1922.

The possibilities of the utilisation of rubber latex for the manufacture of paper has aroused considerable interest. The author has invented a process for mixing the latex as it comes from the tree with the pulp from

which paper is made, and has experimented with several kinds of fibre, the results indicating that the hydration of fibre is modified and stimulated by the action of the latex. Both the material condition and physical qualities of the fibres are improved and strengthened.

After thoroughly mixing the latex with the pulp, which may be done in the beater, a coagulative agent is then added (acetic acid, formic acid, etc. may be used). The nature and quantity of this agent will vary with the nature of the latex employed. Following the coagulation, the ordinary system of paper making is adopted.

According to reports received, a very satisfactory paper has been manufactured by this process, using the latex of *Hevea brasiliensis*, and containing from 0.5 % to 5 % of rubber to the weight of dried paper ; much more resinous latices have been successfully used to produce papers for special purposes, containing as much as 10 % coagulative material. As the quality of the paper is evidently improved by this process, the time of beating, may, in many cases, be considerably shortened, thus reducing the cost of manufacture.

An interesting table gives comparisons of papers produced from fibres without and with rubber latex. Amongst the list are noted :

Fibra	Without latex		With latex	
	Folding resistance	Bursting strength	Folding resistance	Bursting strength
		lb.		lb.
Cotton waste . . . . .	220	31	1 300	40
Cotton linters fibre . . . . .	99	30	6 625	53
Sisal hemp . . . . .	700	32	8 000	40
Id. . . . .	927	41	3 100	52
Manilla hemp (old rope) . . . . .	726	41	24 000	60
Jute (waste) . . . . .	330	30	2 125	54
Waste flax . . . . .	38	25	800	40

Bursting strength = lb. per sq. inch. calculated to a thickness of 0.1 mm.

The rubber does not appear to have any deleterious effect upon the colour of the finished material. Experiments with cotton linen, bleached, sulphite, bleached esparto, bleached straw, and bleached bamboo have proved this statement. In addition to this, the texture is improved. It has been found also that paper containing rubber latex is rendered more waterproof, and is likely to prove very suitable for loading purposes. Experiments are being conducted in this respect. In any case it appears certain that latex paper will be valuable for many purposes.

As regards the economic value and costs attached to this process, the practical commercial experiments made up till the present have shown that the labour costs etc. are negligible. Till the latex is more or less standardised on the plantations, the amount of rubber in the latex in each

delivery can be determined by pouring a limited quantity of the latex into methylated spirit or acetone and then drying and weighing the solid coagulum. The actual cost of latex will naturally be controlled by the current price of rubber, freightage, etc. but it is estimated that the cost of the latex for a paper to contain 0.5 % of rubber would be 12 to 18s. per ton of paper made.

By using very strong fibres, such as Manila hemp, sisal hemp, jute, etc. and using higher percentages of rubber, say up to 20 % or more, the author considers that products can be made to take the place of leather for many purposes. Linoleum substitutes can be made cheaply and abundantly on a paper making machine by using mechanical wood, waste paper and various other fibres, with loading material and increasing the quantity of rubber latex. Recent experiments have shown also that many kinds of asbestos goods, such as high pressure packing can be made more cheaply.

Experiments on a commercial scale have been made already in certain paper mills in England and further tests are to be made shortly with a view to the importation and utilisation in the near future of large supplies of latex for use in the paper industry

M. L. Y.

INDUSTRIES  
DEPENDING  
ON ANIMAL  
PRODUCTS

- 637 - **Investigations on Milking Machines: their Efficacy, Advantages in Labour Saving, and their Sterilisation.** — I WOLL, F W, Investigations with Milking Machines, in *California University Agricultural Experiment Station, Bulletin*, 311, pp. 31-34, 3 fig., Berkeley, 1919 — II RIDDFI, F F, Machine versus Hand Milking, in *Michigan Agricultural Experiment Station, Quarterly Bulletin*, v 1, No 1, pp 163-164 East Lansing, 1919 — III BRADFORD, R S, Methods of Caring for Milking Machine Tubes, in *Journal of Dairy Science*, v V, No 1, pp 102-109, bibliography of 15 works Baltimore, Jan 1922

I — EFFICACY OF MILKING MACHINES — Part of the herd of the "College of Agriculture" of the California University was milked by hand and a part by machine and on correcting the figures of the actual yield so as to make them correspond to that given entirely by 5 year old cows, 153 kg  $29 \pm 3.68$  was shown as the average annual production of butter for cows milked by machine and 160.07  $\pm 4.67$  for those milked by hand.

As the probable error in calculation, must have been comparatively great, the difference cannot be attributed to methods of milking.

The correction of the figures of the actual yield was made by increasing the yield by cows of less than 2  $\frac{1}{2}$  years at the beginning of the milking period, by 30 % ; that of cows between 2  $\frac{1}{2}$  and 3 years by 24 % ; and for each successive increase in age of 6 months by progressively decreasing percentages (18 — 15 — 8 — 5).

II. — LABOUR EMPLOYED IN MACHINE, AS COMPARED WITH THAT IN HAND MILKING — The data relating to the labour required in hand and in machine milking are taken from 93 farms in the Michigan districts where the condensed milk industry is very important. These data are summarised in the annexed Table



*Labour needed for machine as compared with that for hand milking*

	Number of herds	Average number of cows per herd	Work per cow per year			Work per quintal of milk		
			Milking	Care of milk and utensils	Total	Milking	Care of milk and utensils	Total
			hours	hours	hours	hours	hours	hours
<i>Machine milking:</i>								
Average for all the herds . . . . .	51	18.2	57.9	13.4	71.3	2.11	0.46	2.57
Average for the herds containing up to 15 cows. . . . .	17	13.1	65.2	14.7	79.9	2.30	0.48	2.78
Average for the herds of more than 15 cows . . . . .	34	20.8	55.6	13.0	68.6	2.05	0.46	2.51
and Milking: All the herds . . . . .	42	13.6	89.2	11.2	100.4	2.78	0.35	3.13

III — STERILISATION OF THE MILKING MACHINES — Owing to the fact that those who use mechanical milkers often do not know exactly how to sterilise them, and the neglect of the makers to give instructions on this subject for the machines they sell, large quantities of milk have been produced in the United States containing an excessive number of micro organisms. Partly for this reason and partly on account of the return to the country of more abundant labour, hand milking is again competing seriously with machine milking in the States.

It has been absolutely proved that the chief source of the bacterial contamination of milk is the dairy utensils with which it is brought into direct contact (1). The best means of avoiding this is to carry out thorough sterilisation of all parts of the apparatus. These methods have been proposed, *a*) by heat; *b*) by chemical agents; *c*) by cooling.

The first is very efficacious, provided it is done with boiling water or steam, but has the disadvantage of spoiling the rubber parts of the ma-

(1) M. Y. PRUCHA and H. A. HARDING (Elimination of Germs from Dairy Utensils (1) by Rinsing; (2) by Drying in Sun and Air, in *Illinois Agricultural Experiment Station Bulletin* 230, pp 139-168, Urbana, 1920) have proved by experiment that the chief causes of the bacterial contamination of milk are the dairy utensils and not the air, the construction of the stable, or the way in which the ordinary work of the stable and the dairy is carried out. Washing the cans in hot water and drying them in the sun bottom upward is a very effectual means of destroying germs especially when done by machinery. A hot solution of soda quickly loses its germicidal power through neutralisation and cooling, if passed from one can to the other. — J. J. HOOPER and J. W. NUTTER (The Production of Cream Milk at the Kentucky Agricultural Experiment Station, in *Kentucky Agric. Exp. Sta. Circular*, 24, 15 pp 12 fig Lexington, 1920) report that at the Kentucky Agricultural Experiment Station unboiled milk containing only a very small number of bacteria has been produced and sold, by means of: cooling the milk just taken from the cow, carefully sterilising the utensils after washing and again before using them; simple, but not primitive apparatus, and the elimination of milk coming from inflamed mammals. (Ed.)

chine. This has been remedied by making rubber tubes which remain unharmed by this mode of sterilisation, but only with partial success as regards those parts which must necessarily be "estampées" of solid material.

As chemical agents the following have been suggested : A solution of boric acid, slaked lime, formaldehyde, a solution of common salt, soap powder, etc. It has been observed that the most effective of these is common salt, but it has the disadvantage of corroding certain metallic parts. RUEHLE, BREED and SMITH (*New York Agricultural Experiment Station, Bulletin* 450, 198) have proved that the micro-organisms which live in brine cannot thrive in milk and vice-versa. WING (*Cornell University Agricultural Experiment Station, Circular* 18, 1913) has proved that brine can be easily and efficaciously sterilised by the addition of hypochlorite ; the mixture, solution of common salt + hypochlorite, therefore, will be found to be a really effective means of chemically sterilising those parts of the milking machine which are not proof against heat.

The third method has been used with success by several breeders of New York State, where cold springs abound. It is rather a preventive measure, and consists in rinsing, between two milkings, the tubes and receptacles of the milking machine by passing cold water through and over them. To be effective, the water should be at a temperature below 10° C.

F. D.

638 - **Investigations on the Chemistry of Milk and Dairy Products, made in the United States.** — I. PALMER, L. S., The Preservation of Milk for Chemical Analyses, in *University of Missouri, College of Agriculture, Agricultural Experiment Station Research Bulletin* No 34, 31 pp., bibliogr. of 26 works. Columbia Missouri, 1919. — II. PALMER, L. S., The Chemistry of Churning, *Ibid*, *Bulletin* 163, pp. 40-41, 1919. — III. SUPPLEE, G. C., The Lecithin Content of Butter and its Possible Relationship to the Fishy Flavour, in *Cornell University, Agricultural Experiment Station, Memoir* 29, pp. 101-151, 1 pl. Ithaca, N. Y., 1919. — IV. CUSICK, J. T., Phosphorus in Butter, *Ibid*, *Memoir* 30, pp. 159-187, 1920. — V. HEPBURN, N. W., A Modified BABCOCK, Method for Determining Fat in Butter, *Ibid*; *Memoir* 37, pp. 669-690, 1920. — VI. SUPPLEE, G. C. and BELLIS, B., Fat Analysis of Milk Powder in *Journal of Dairy Science*, v V, No. 1, pp. 39-50, bibliogr. of 8 works. Baltimore, Jan. 1922.

I. — **THE PRESERVATION OF MILK FOR CHEMICAL ANALYSES.** — Detailed investigation as to the effect of various factors on the preservation of milk for chemical analyses ; it treats of : quality and quantity of the preservative ; temperature during preservation, development of micro-organisms before the addition of the preservative ; quantity of air in contact with the milk ; relative importance of bacteria and enzymes in the decomposition of milk ; minimum quantity of best preservative to use.

Of the antiseptics tested (formaldehyde, corrosive sublimate, bichromate of potassium, sulphate of copper, thymol, toluol), formaldehyde is the best because it causes the fewest alterations in the milk constituents. The author has devised the following method, which permits of the milk being preserved unaltered for analysis for several weeks.

Carefully stir the sample of milk which has just been taken from the

cow ; measure out exactly 1 litre and then to 1.5 to 2 cm of formalin (containing approximately 40 % of formaldehyde), place in a bottle, preferably sealed, sufficient to fill about  $\frac{9}{10}$  of the bottle ; cool rapidly to 8-10° C or under and keep the milk at this temperature until it is analysed.

II. — THE CHEMISTRY OF CHURNING — The microscopic examination of butter made from cream coloured with Sudan III and fuchsin confirms FISCHER's theory that churning is the transformation of an emulsion of fatty matter contained in a hydrated colloid (cream) into an emulsion of hydrated colloid contained in fatty matter (butter)

III — THE LECITHIN CONTENT OF BUTTER AND ITS POSSIBLE RELATIONSHIP TO THE FISHY FLAVOUR — If trimethylamine be added to cream or to butter before preparation, the butter when made has a fishy flavour (See R. Sept 1913, No 1087) In commercial butters having a fishy flavour, the author has noticed (by means of a special micro-reaction) the presence of trimethylamine The hypothesis that the characteristic flavour caused by this alteration is due to the presence of trimethylamine arising from the decomposition of lecithin is therefore correct The presence of the latter has been observed by the author and by J T CUSICK

In order to ascertain the biological conditions which produce the fishy flavour, samples of cream are inoculated with micro-organisms isolated from butter having a fishy flavour, especially when *Bacterium ichtyosmius* Hammer or some other micro-organism not identified had been inoculated *B. ichtyosmius* decomposes the choline (a lecithinic base) and sets free trimethylamine. The action of specific bacteria is therefore sufficient, if not necessary, to produce trimethylamine in butter

IV. — PHOSPHORUS IN BUTTER — The pasteurisation of cream renders the organic components of phosphorus more soluble, so that they are lost in churning This loss (in freshly made butter) is greater in the case of ripe creams than in that of fresh creams, whether pasteurized or not. After storage for 15 months the greater part of the soluble organic phosphorus is transformed into inorganic phosphorus. Butters made from ripe cream, pasteurised or otherwise, had a tendency to retain more soluble organic phosphorus than the others About  $\frac{2}{3}$  of the total amount of phosphorus in the cream remains in the buttermilk and only 25 % passes into the butter ; the difference is lost in the water used in washing and in that which drains from the salted butter.

V. — A MODIFIED BABCOCK METHOD FOR DETERMINING FAT IN BUTTER — HEPBURN has compared the BABCOCK container for samples of 6 gm and that for samples of 9 gm for determining fat in butter. The difference observed in the results thus obtained is slight and quite negligible in practice. For this reason the author advises the use of a container for 9 gm. on the grounds of convenience.

VI. — FAT ANALYSIS OF MILK POWDER. — The Association of Official Agricultural Chemists has not yet indicated an official method for determining fat in milk powder. The ROESE-GOTTLIEB method however, is generally considered to be the best for this purpose, though numerous

modifications of existing methods have been proposed SUPPLEE and BELLIS have submitted several to comparative tests and have obtained results from which they draw the following conclusions

1) Normal variations in results obtained should not exceed 15 % of the powder analysed

2) The diminution of fat content ( % of the powder analysed) in old powders is only apparent it is due to moisture absorbed by them

3) The method by simple extraction with ether gives results 25 % inferior, on an average, to those obtained with the ROESE-GOTTLIEB (MO-JONNIER) method

4) The RIMMOND modification of the BABCOCK method by centrifuging, does not give reliable results

5) The ROESL-GOTTLIEB method modified by making the extraction with an acid instead of an alkaline medium generally gives better results

F D

639 - Investigations on the Bacteriology of Milk and Dairy Products (1), made in recent Years in the United States. - I PAKER I C BREW J D and CONN H J Relation between Lactic Acid Production and Bacterial Growth in the Souring of Milk in *New York Agricultural Experiment Station Technical Bulletin* 74 21 pp figs 5 Geneva 1911 - II BRIDGES and SROCKING Jr The Accuracy of Bacterial Counts from Milk Samples *Ibid Technical Bulletin* 75 97 pp 1910 - III JENSEN S O The Lactic Acid Bacteria in A *Dansk Vidensk Selsk Ski Naturvidensk o Math Afa* series VIII vol V No 1 pp 81 106 1911 summarized in *Experiment Station Record*, v 1 No 1 pp 650 661 Washington Nov 1920 - IV HAMMER, B W Studies on Abnormal Evaporated Milk in *Iowa, Agricultural Experiment Station Research Bulletin* 5 pp 187 198 1911 - V HAMMER, B W Studies of Formation of Gas in Sweetened Condensed Milk *Ibid, Research Bulletin* 54 pp 211 220 figs 1911 - VI HAMMER B W and BAILLY, D E, The Volatile Acid Production of Starters and of Organisms Isolated from them, *Ibid Research Bulletin* 55 pp 221 246 1919 - VII HAMMER, B W Bacteriological Results obtained in Practice with Vat Pasteurization and with one of the Final Package Methods *Ibid Bulletin* 190 pp 150 158, 1919 - VIII Experiments with Dairy Produce in Wisconsin *Agricultural Experiment Station Bulletin* 319, pp 43 14 Madison 1920 - IX Keeping Quality of Butter, in *Minnesota Agricultural Experiment Station Report* 1911 pp 44 45, St Paul 1920 - X Dairy Products, in *University of California, College of Agriculture, Agricultural Experiment Station Report* 1919, pp 76 77 Berkeley, 1920 - XI *Ibid Ibid Report*, 1920, pp 72 74 1921 - XII AUCKER G J The Microscopic Study of Bacteria in Cheese in *New York Agricultural Experiment Station Technical Bulletin* No 87 11 pp, bibliogr of 12 works Geneva, Oct 1921 - XIII REDFIELD, H W, The Determination of Yeasts and Oidia in Cream and Butter, in *Journal of Dairy Science* v V No 1 pp 14 21, bibliogr of 12 works Baltimore, Jan 1922

I - RELATION BETWEEN LACTIC ACID PRODUCTION AND BACTERIAL GROWTHS IN THE SOURING OF MILK - Two samples of pasteurized skimmed milk containing a small number of bacteria, and from the same cow, were

(1) See I H ECKHART, Valuable Bulletins and Circulars for the Dairy Farmer and the Manufacturer of Dairy Products in *University of Minnesota, Agricultural Extension Division, Spec Circular* 2, 4 pp St Paul, 1919 - Bibliogr including especially the works of the Department of Agriculture and Agricultural Experiment Stations in the United States (Ed)

inoculated each with a different culture of *Streptococcus lacticus* and incubated at 25° C. The estimations of sourness and the bacterial count were performed at half hour or one hour intervals 15 hours after inoculation. In one case there was approximately the expected increase in the number of bacteria (double for each generation) but in the others the speed of multiplication was much slower and remained fairly constant during the whole period of systematic observation. The quantity of acid produced was approximately in proportion to the number of bacteria present. In a vigorous culture a single cell produced 5, 10- and  $10^{10} \times 10^{-10}$  milligrams of lactic acid per hour.

II — THE ACCURACY OF BACTERIAL COUNTS FROM MILK SAMPLES — By means of 3 parallel series of bacteriological analyses of milk the authors have observed a close agreement between the number of isolated groups of micro-organisms (clumps) of one or several species counted directly under the microscope or on the agar plate.

In the isolated groups the average number of individuals generally varied between 2 and 6 but sometimes when there were streptococci it was much higher.

The bacterial count on the plate does not represent the total number of bacteria present in the isolated groups of micro-organisms (clumps) are very incompletely broken up in the process usually employed for diluting liquids.

III — THE LACTIC ACID BACTERIA — Monograph in which the cultural character and source of energy and food used by the species in question are especially shown. It is based on 10 year work and on the culture of 330 stocks isolated from milk and dairy products, excrements and vegetable matter.

The lactic acid bacteria are considered by the author to be a group of non-motile rod-shaped or spherical forms producing no spores, gram positive, deprived of catalase and which ferment producing chiefly lactic acid. The dextrorotary or levorotary optic activity constitute an important diagnostic character as the optic properties are not influenced by the quality of the sugar fermented. Five genera (*Thermobacterium*, *Streptobacterium*, *Betabacterium*, *Streptococcus* and *Betacoccus*) comprising 22 species, are known to be true bacteria producing lactic acid, and two genera (*Microbacterium* and *Tetracoccus*) are very analogous forms.

The true lactic acid bacteria are incapable of decomposing amino acids not in combination and comparatively few have a marked proteolytic action. The coccus which decomposes casein, does this slowly and forms peptones, these are then broken down into amino-acids, but the rod-like forms which decompose casein set free the mono-amino acids from the casein molecule without a preliminary formation of peptone. From the peptones, the lactic acid bacteria form a quantity of polypeptides which are not precipitated by phosphotungstic acid.

The author observed that a number of lactic acid bacteria, if cultivated in milk, produce, especially at a low temperature a saliva, due to the swelling of the capsules, more or less distinct, which surround the cells.

at certain phases of the culture *Streptococcus cremoris* (a new name), which is the typical micro-organism of the starter, *i. e.*, the inoculation cultures used in making butter, also produceropy milk. The best stocks of *S. cremoris* for making butter have, it seems, the lowest power to ferment saccharose, maltose and dextrin.

The author, as an experiment made some cheeses with milk practically germ-free and inoculated with pure cultures of lactic acid bacteria. In every case putrid fermentation was greatly reduced.

*Streptobacterium casei* (= *Bacterium casei* α) was the most satisfactory when high temperatures were not used in the process of making the cheeses. The second place is held by *Streptococcus lactis* (= *S. lacticus*) and the third by *L. cremoris*. *Tetracoccus liquefaciens* (= *Micrococcus casei liquefaciens*) renders the cheese rather soft and imparts to it an odour and flavour similar to those of Swiss cheese and cheese from the Russian steppes. The value of *Thermobacterium helveticum* (= *Bacterium casei* ε) is confirmed for cooked cheeses.

IV — NOTES ON ABNORMAL EVAPORATED MILK — A description of the morphological, cultural and biochemical characters of *Bacillus amarus*, a new micro-organism isolated from evaporated milk having a bitter flavour and abnormal odour. Evaporated sterilised milk, inoculated with this bacillus curdles after some months and the bacillus almost entirely disappears.

V — NOTES ON FORMATION OF GAS IN SWEETENED CONDENSED MILK — A sweetened condensed milk after the closing of the tins, undergoes gaseous fermentation. A new yeast *Torula lactis-condensi*, has been isolated from it and observed to be the cause of this alteration.

VI — THE VOLATILE ACID PRODUCTION OF STARTERS AND ORGANISMS ISOLATED FROM MILK — None of the micro-organisms isolated from a "starter" and cultivated in milk produce strong acidity, whereas the mixed cultures of *Bacterium lactis acidum* and some of these micro-organisms (incapable alone of curdling the milk) produce a volatile acidity approximately equal to the characteristic acidity of good "starters." It must be concluded that the combined action of the micro-organisms present in the "starter" is necessary to obtain the desired volatile acidity.

VII — BACTERIOLOGICAL RESULTS OBTAINED IN PRACTICE WITH MILK PASTEURISED BEFORE AND AFTER BOTTLING — Milk sterilised after bottling gave a smaller number of samples with a high percentage of bacteria than milk sterilised in the vat and then bottled.

VIII — RESEARCH IN DAIRY PRODUCTS AT THE WISCONSIN AGRICULTURAL EXPERIMENTAL STATION — Cheddar cheese made with sterilised milk has no flavour. To remedy this defect, E. G. HASTINGS and J. L. SAMMIS have used a special "starter" containing, besides lactic acid bacteria, micro-organisms isolated from the ground and from excrements.

H. H. SOMMER has observed that milk sufficiently acid to be capable of titration, does not imply that it will curdle after sterilisation, condensed milk factories therefore have no reason for refusing very acid milk.

Curdling is principally due to an excess of soluble salts of calcium and the tendency to curdle may easily be corrected by the addition of the proper citrates or phosphates

**IX — EFFECT OF ENZYMES AND MICRO-ORGANISMS ON THE KEEPING QUALITY OF BUTTER** — As a result of researches made at the Minnesota Agricultural Experiment Station 1) butter made from cream pasteurized at 80° C (a temperature which destroys the enzymes) keeps better than that made from the same cream heated to the ordinary temperature of 63° C (enzymes still active), 2) by placing a small quantity of "starter" in the churn, butter made from fresh cream has a better odour and flavour than that obtained by the old system of letting the cream ripen in the pan before churning

**X and XI — EXPERIMENTS ON DAIRY PRODUCTS MADE AT THE CALIFORNIA AGRICULTURAL EXPERIMENT STATION (I) — L. S. DENNING** has observed that butter cut into blocks weighing 900 gm wrapped in parchment paper, covered with a solution at 20 % of common salt and kept at 10° C were still in a good state of preservation after 8 months

The following conclusions arrived at on the use and bacterial composition of the "starter" are chiefly based on the works of A. S. BAIRD

1) The use of a "starter" containing *Bacillus bulgaricus* produces a thin cheese of good quality from skimmed milk,

2) Pasteurised milk ripened with *B. bulgaricus* produces a rather firm Cheddar cheese,

3) A pure culture of *B. bulgaricus* used as a 'starter' is more effective than a culture of *Streptococcus lacticus* (*B. lactis acidus*) for preventing gaseous fermentation in cow-paste cheese ("California cheese"), but the odour and flavour are not uniform

Regarding researches on the possible substitutes for rennet, it was observed that pepsin makes a tough cheese, and thus, it seems, should be attributed to the fact that, to cause curdling, pepsin needs more acidity than rennet. A mixture of equal parts of pepsin and rennet, on the other hand gives satisfactory results

II. S. BAIRD has investigated the use of 'starters' for making Cheddar cheese from pasteurised milk, he has observed that no culture

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(1) Other interesting studies, described in the 1920 Report, deal with the keeping of milk and butter — C. L. ROADHOUSE and J. C. MARQUARDT have examined milk kept in refrigerators cooled by a current of water and have observed that bottled and pasteurized milk can be kept in them without becoming sour for at least 24 hours. Of these refrigerators, those with linen partitions are as efficacious as those of cement. In an experiment made by S. L. DENNING, a certain quantity of butter was kept at the room temperature, from 13th June, in brine of different strengths. On 22nd July, the best preserved sample was that which had remained in a solution of 30 %. The sample in a saturated solution (at 40 %) took the second place, while that in a 20 % solution was in a worse condition than the sample wrapped in paper which had not been in brine. On 14th October, none of the samples kept at a natural temperature were in good condition, those kept in the refrigerator, on the contrary had not deteriorated (Fd)

gives favourable results with pasteurised milk at 75° C by the continuous heating process.

Some of the cultures give more favourable results with milk kept at 63° for 20 minutes and then cooled to 30° C. The cultures were obtained from milk in its natural state.

XII. — THE MICROSCOPIC STUDY OF BACTERIA IN CHEESE. — HUCKER quotes the works of several authors (JOHAN-OLSEN, TROILI-PETERSON, GORINI, RODELLA) who formerly used the process of direct microscopic examination of microtomic sections of cheese, and describes the technical method which he himself has used in this process, and the results he has obtained in applying it to the study of bacterial flora in Cheddar cheese.

He cuts the sample under consideration into small cubes which are imbedded in paraffin wax and then cut into sections 5  $\mu$  in thickness with the Minot rotary microtome. The sections are then stained by the Gram method, followed by methylene blue.

The number of micro-organisms determined by this direct examination was much greater than that obtained by the ordinary cultural method. The two methods together give much more satisfactory results than those obtained with one alone.

XIII. — THE DETERMINATION OF YEASTS AND OIDIUM IN CREAM AND BUTTER. — Among the various factors which determine the preservation of butter, several authors have attached importance to yeasts and *Oidium lactis*. REDFIELD has devised a special method of investigation to enquire into the matter. The results obtained, which he sets out in tabular form, show that the actual number of micro-organisms present in butter recently made is of little importance. The addition of "starter" introduces bacteria of the pure acidifying type in such quantities as to predominate in the bacterial count at this phase. The other groups represented only occasionally show an insignificant number of micro-organisms. The micro-organisms of the peptonising group abound only in butters of very inferior quality. On the whole, butters of inferior quality contain a large number of yeasts and *Oidium lactis*, but there are sufficient divergences to indicate that the deterioration of the butter is also caused by other agencies as yeasts and oidium are present both in inferior qualities of cream and of butter. It is possible that in the final product their number is in correlation with the condition of the cream treated (1). F. D.

(1) Ice cream may be included in the category of dairy products (see: W. W. FISK, *The Book of Ice Cream*, p. XVIII, + 302, 88 fig. New York, Macmillan Co., 1919). The following may be cited as bacteriological studies on this subject: 1) HAMMER, B. W. and SAUNDERS, L. R., A Bacteriological Study of the Method of Pasteurizing and Homogenizing the Ice Cream Mix, in *Iowa Agricultural Experiment Station, Bulletin* 186, pp. 17-26. Ames, 1919; 2) ELLENBERG, H. B., A Study of Bacteria in Ice Cream during Storage, in *Cornell University Agricultural Experiment Station, Ithaca, N. Y.*, 1919. From the results of his researches the author declares that: 1) with agar plates the number of bacteria is greater than with those of gelatine; 2) the use of tournsol slightly increase this number in either case; 3) incubation at 20° C for 7 days gave the best results of all those tested for the



640 - **Influence of Surroundings and Temperature of Incubation on the Bacterial Count of Milk.** - SUPPLÉ, G. C., WHITING, W. A., and DOWNS, P. A., in *Memoir 43, Cornell University, Agricultural Experiment Station and The Creamery and Milk Plant Monthly*, v. XI, No. 2, pp. 25-26. Chicago, Feb. 1922.

The present methods of counting bacteria in milk give only approximate results which cannot be used for purposes of comparison. They are undoubtedly of great use in safeguarding the interests of consumers in large towns as is shown by the report (1917) of the "Committee on Statistics of Milk and Cream Regulations of the Official Dairy Instructor Association". This Committee has brought together all the regulations concerning the sale of milk in 409 towns of large and medium size, in the United States, and has observed that 189 of these towns impose a legal limit for the number of bacteria in milk sold in the municipality. The limits allowed vary for the different towns from 50,000 to 5,000,000 per cubic cm; about half the number of towns adopt the limit of 500,000. The necessity of fixing legal limits for the bacteria in cream has not seemed so urgent, for 30 only of the 409 towns have done so; these limits range from 50,000 to 1,000,000 organisms per cub. cm.

The inaccuracies inseparable from the present methods of counting bacteria are too great to allow of attaining that degree of accuracy which would seem to be guaranteed by the fact that typical numerical limits have been adopted.

The American Public Health Association, recognising the enormous variations observed in the results furnished by the ordinary method of plate counting, drew up in 1915 a method of counting micro-organisms in milk called "The Standard Method of Bacterial Analyses of Milk", which includes the use of pure agar plates and incubation for 48 hours at 37° C.

The general use of this method has the advantage of giving results more easily compared, but still far from uniform, as COVY found in 1915 by having the same milk examined by four different laboratories.

The reasons for disagreement in the results of plate counts are numerous. 1) certain species do not produce colonies visible among their surroundings and at the incubation temperature employed, 2) tendency of several spe-

growth of ice-cream bacteria on agar plates. In the bacterial count by the plate method, the most serious errors are caused by the inequality of distribution in the final dilution with water. The various ingredients used in the manufacture of ice cream -- milk, cream and condensed milk -- are the most fruitful sources of bacteria. By subjecting them to thorough pasteurization, a small number of bacteria only will be found in the ice cream. In addition to the contamination due to the apparatus used, there is generally an increase in the number of bacteria caused by the freezing process, which might be attributed to the breaking up of clumps of micro-organisms.

There is no radical change in the total number of micro-organisms in ice cream during storage. But there seems to be a slight decrease during the first 2 to 4 days, followed by a greater increase and then again by a corresponding decrease between the 4th and 21st days, after which there is a very slow decrease. The bacterial groups do not appreciably change during storage. The acidifiers predominate throughout the period of storage, and several of them, it appears, belong to the *Bacterium lactis acidii* group. (Fd.)

cies to exist in groups of 2 or 3 individuals more or less completely broken up during the preparation of the plate ; 3) too few or too many colonies on the plate ; 4) hindrance or beneficial effect of the diffusion of the sub-products of the growth of certain species on others within the radius of diffusion ; 5) personal error, etc.

The " Standard Method " has fixed the minimum number of colonies at 30, and the maximum at 200, per plate ; according to Messrs BREED and DOTTERIER (1916), the limits 30-400 give equally satisfactory results.

Several authors have noticed that the use of agar plates to which have been added carbohydrates, and a longer period of incubation at a lower temperature, have several advantages ; the authors have therefore examined the variations in bacterial counts effected at different incubation temperatures, and with agar disks with or without the addition of carbohydrates.

The samples used in these experiments were taken indiscriminately from the market at Ithaca at frequent intervals during a period of 18 months. With the same dilution of each sample 27 plates were made : 9 of agar, 9 of agar + 1 % of dextrose, 9 of agar + 1 % of lactose. The agar was all of the same quality. In each group of 9 plates 3 were incubated at 37° for 48 hours, 3 at 30° for 5 days, and 3 at 20° for 5 days. For all the rest the authors adhered strictly to the " Standard Method " process.

From the results, arranged in tabular form, the following conclusions may be drawn.

The great differences observed in the counts made on different substrata and at different incubation temperatures, clearly show the insufficiency of any combination of temperature and substratum to determine the maximum number of bacteria in the different samples of milk. Pure agar at 37° for 48 hours is certainly the least adequate combination for the purpose ; the use of agar with galactose at the same temperature has few or no advantages over agar used alone, the majority of the results given by it are inferior to those obtained by incubation at 30-20° for 5 days.

To obtain the largest numbers of bacteria, agar with dextrose at 30° for 5 days appears to be superior to all other combinations treated in this work.

The numbers of bacteria obtained at 37° after 48 hours, are probably subject to greater divergencies than those obtained at lower temperatures with longer periods of incubation. It has been proved that normal variations of temperature in a large number of plates in close proximity, are sufficient to cause in the same sample of milk, a possible 50 times greater number of bacteria ; whereas if the plates are sufficiently wide apart to enable the air to circulate freely between them, a variation of not more than three times the number is obtained. When experimenting at a temperature of 35°, therefore, the incubator must be sufficiently ventilated to permit of all the plates being equally heated.

The possible variations in the numbers of bacteria due to the present method of counting do not imply that this method is useless ; but its limitations should be recognised and the grading of milk into various

classe of purity and keeping quality should not be based exclusively on it.

To harmonize these variations with the typical methods of examination, all factors which tend to cause variation and disagreement should be reduced to a minimum.

F. D

- 641 - **Variations of certain Characters of the Fatty Matter in Buffalo and Cow-Milk, corresponding with Change of Season and Feeding.** — PLYMPER, F. J., and AIYER, A. R. P., in *Memoirs of the Department of Agriculture in India, Chemical Series*, v. VI, No. 4, pp. 187-208, tab. 5, Calcutta, 1921

For the purposes of inspection and determination of the degree of purity and of the other characters of butter and of dairy products, numerous States have adopted technical methods based on the chemical properties of the fats contained in these foods, such methods are those of REICHERT-MEISSL (which reveals the relative quantity of volatile fatty acids) — POLENSKE (which differentiates the volatile fatty acids soluble in water from those which are insoluble) — AVELLEMENT (which is of practical importance because it enables the purity or adulteration of butter to be ascertained by means of the relative solubility in water of the barium salt contained in the fatty acids), etc

Very few researches have been made on this subject in British India, and the authors proposed to remedy this by making a series of investigations based on the above methods, to determine the physical and chemical properties of pure butter made from the milk of cows and buffaloes fed under well-defined conditions.

These investigations completed, both in the case of isolated animals and herds, and set forth in detail in 5 tables, gave the following chief results: a) from each animal butter may be produced with characters widely differing from those of the total produce of a herd; b) in the case of the total product from a herd, the divergence of the characters considered to be normal is more accentuated during the months in which warm and dry weather prevails; c) the ordinary chemical and physical determinations do not permit of distinguishing the fat of cow butter from that of buffalo butter; d) if the numerical indices adopted in other countries be considered as minimums of purity, a great part of the fatty matter of butter produced from the milch-cattle of India must be taken as altered

E. F.

- 642 - **The Reciprocal Application of the Numerical Indices of the Characters of the Fat in Cow Butter and in "Ghee" (clarified Buffalo Butter).** — PLYMERS, F. J. and AIYER, A. R. P., in *Memoirs of the Department of Agriculture in India, Chemical Series*, vol. VI, No. 5, pp. 209-214, 4 diagr. Calcutta, Oct. 1921

The fatty matter of butter reaches the market after passing through numerous and varied processes, according to circumstances, and in consequence the numerical indices usually employed to estimate the degree of purity cannot always be compared. Especially is this the case when the comparison is made between ordinary butter (from the cows), which is prepared at a low temperature, and clarified buffalo butter (the "ghee")

of the Hindoos), which is subjected to a high temperature during its preparation.

In the researches made on this subject, the authors have used butter and "ghee", each prepared from the same sample of milk (both cow and buffalo), and have subjected the cream to the different processes generally employed in India in the preparation of butter for the market. The results obtained clearly show that the different methods of ripening cream and preparing cow-butter at a low temperature or "ghee" at a high temperature have no appreciable effect on the numerical indices usually employed in estimating their purity.

Investigations were also made with samples of the fatty matter of butter and "ghee" kept from 3 to 5 years, and it was proved that the fact of heating butter fat to a high temperature, as is done in the manufacture of "ghee", does not modify the numerical indices of its characters, nor the conclusions which may be drawn therefrom.

In conclusion, the indices relating to butter fat may also be applied to "ghee", and *vice-versa* E. F.

(43) - **Manufacture of Cheese of the Roquefort Type with Cows Milk in the United States.** — MATHESON, K. I., in *United States Department of Agriculture, Bulletin* 970, pp. 28, figs. 11. Washington, 1921.

Detailed rules are given for the manufacture of the Roquefort type of cheese from cow's milk. These rules are based on the experience gained in cheese-making in the Dairy Division of the Department of Agriculture of the United States at Grove City, Pennsylvania. The care necessary during ripening is especially studied, and manufacture of this type of cheese is not advised in cheese factories which have not the necessary apparatus for ripening well.

The Roquefort cheese produced in France is made from ewe's milk and is one of the earliest of which mention is made. The average composition of a good Roquefort cheese is approximately as follows: Water 38%; fat 32%; protein 20%; minerals 6%, including 4% of sodium chloride.

Ewe's milk differs both physically and chemically from that of the cow. The relation between fats and protein, however, is almost the same.

The use of clean, fresh milk is essential. From 3 to 4% of "starter" (which sets up fermentation) is used and the milk is given an acidity of 20-23% before being curdled. It is heated to 28-29°C and curdled with rennet in the proportion of 190 to 250 gms. per 1000 gms. of milk. The curd is allowed to stand for 1 hour or 1½ hours and then broken, and ten minutes afterwards thrown into a cloth and left to drain for about twenty minutes. When the curd is put into the mould, it is sprinkled three or four times with *Penicillium glaucum* powder. The cheese is turned three or four times the first day and afterwards at least twice a day until the salting. The temperature of the room in which the cheeses are ripened should be from 18 to 20°C and the moisture from 85° to 90°. In this room the cheeses are washed daily for four or five days, after which they

are salted in a special room in which the temperature is kept at 9° and the moisture between 80° and 90°.

The salting lasts from 8 to 10 days. Special apparatus is necessary to ensure the right temperature, moisture and ventilation. The cheeses are then pierced thirty or forty times and placed on shelves edgewise and not on their flat surfaces.

By the use of a refrigerator and special apparatus, the cheeses ripen at 7-10° C with slight ventilation. During the salting and wrapping in tin-foil, the air should be dry and fresh.

The cheeses are left to ripen two or three months, during which time, they are scraped every three or four weeks; the total loss from the scraping is 7-8 %.

After ripening, the cheeses are wrapped in tin-foil and stored for at least one or two months.

At Grove City the cost price of the Roquefort type of cheese was estimated at 46 cents per pound. With milk containing 4% of fat, the production of cheese should be from 10 to 11 kg. per 100 kg. of milk.

The cheeses when finished are wrapped in tin-foil lined with parchment paper and packed in cotton wool, in cases, 12 in each case.

With proper apparatus and skilful labour, the Roquefort type of cheese may be successfully prepared from cows milk. F. D.

# PLANT DISEASES

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## GENERAL INFORMATION

LEGISLATIVE  
AND  
ADMINISTRATIVE  
MEASURES  
FOR THE  
PROTECTION  
OF CROPS

644 - Decree of December 21, 1921, No. 15198 Sanctioning the Regulations relating to Plant Diseases in Brazil. — *Diario official*, No 14, January 18, 1922 (cf. International Institute of Agriculture, *Textes législatifs de l'année 1922*, No. 2 (1).

This Decree describes the regulations in force in Brazil respecting the trade in plants, or parts of plants, their importation, transit, and exportation.

Throughout the national territory all trade importation or transit is forbidden in the case of . 1) living plants, or parts of plants, infected with diseases or parasites recognised to be dangerous, 2) injurious live insects in every stage of their development; 3) cultures of bacteria or fungi injurious to plants; 4) soil and mould that may contain (in any stage of development), fungi, insects or other plant enemies, even if such soil or mould should form an integral part of the said living plants, 5) cases, sacks or other packing material having been used in the transport of the above-mentioned products.

The Ministry of Agriculture, Industry and Commerce shall also be empowered to forbid the importation of any plant product coming from countries suffering from the ravages of diseases or animal parasites, and hence constituting a source of danger to native crops. G. T.

645 - Decree of January 26, 1922, prescribing the Measures of Control of Diseases and Animal Parasites of Plants in the Regency of Tunis. — *Journal officiel tunisien*, No. 20, March 11, 1922 (cf. *Textes législatifs etc* No. 3)

When the injuries caused to cultivated plants by animal or plant, parasites are, or seem likely to become, widespread or to assume serious proportions, the Director General of Agriculture, Commerce and Colonisation passes decrees delimiting the infected areas, and prescribes the necessary measures to destroy the pests and to regulate the transport of plants and parts of plants capable of propagating such parasites.

All owners, including the State, Communes and Public Administrations, or tenants of urban or rural landed property, are required to carry out the measures prescribed by the decrees. For this purpose they may, if belonging to the same or a neighbouring *circondario*, form themselves into co-operative Societies which in some cases may receive a grant.

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(1) Sec R April 1922, No 504 (Pd)

Should the owners or occupiers of the property omit to carry out the regulations in force, the work of destruction may be performed by the authorities at the expense of the interested parties, and without prejudice to the penalties entailed by such omission.

In the case of any infringement of the rules laid down for the transport of plants, the sender as well as the forwarder are jointly responsible. Any plants transported fraudulently are seized and destroyed together with their packing material. If not detected until planted, they will be destroyed at the expense of the offender, who is liable to the same penalties as the sender and forwarder.

G. T.

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

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|---|---------------------------------|
| 646 - Persian "Black-Wheat" ( <i>Triticum dicoccum</i> var. <i>persicum</i> ) resistant to Fungus Diseases. — See No. 564 of this Review  | RESISTANT<br>PLANTS             |
| 647 - "Rubin" an early, Rust-resistant Spring Wheat, for Central Sweden. — See No. 555 of this Review.  |                                 |
| 648 - Sugar-Sorghum and its Rust-Resistant Qualities. — See No. 567 of this Review.   |                                 |
| 649 - Use of "Cambisan" in the Control of various Fungus Diseases of Rubber. — See No. 575 of this Review.  | MEANS<br>OF<br>CONTROL          |
| 650 - Means of Disease Prevention in the Preservation of Acorns and Beech-mast. — See No. 580 of this Review.   |                                 |
| 651 - <i>Bacterium flaccumfaciens</i> n. sp. injurious to Beans in South Dakota. — HEDGES, F., in <i>Science, New Series</i> , Vol. LV, No. 1425, pp. 433-434. Utica N. J., April 21, 1922. | DISEASES<br>OF VARIOUS<br>CROPS |

A new form of bacteriosis has been reported as attacking the ordinary haricot bean in South Dakota. The agriculturist on the estate where the disease was discovered estimates that it caused the loss of 90 % of this crop in 1920. In 1921, he sowed seed taken from the plants that had survived and lost about 25 % of the yield. Some of the seed from the crop obtained at Dakota in 1920 was sown at Arlington (Virginia), and produced a large number of diseased plants many of which never grew beyond the seedling stage.

The disease is characterised by the withering of the leaves of the young plants sometimes accompanied by change of colour and stunted growth, reduced yield, and the death of some of the shoots if the plant has passed the first stages of its development.

Samples of beans from South Dakota were received on August 6, 1921, at the Phytopathological Laboratory at the Bureau of Plant Industry, Washington. It was then discovered that bacteria were present in the vessels of the stem, and that the vascular ring was often of a brownish colour. A yellow micro-organism was isolated from the infected stems

which when inoculated into young, vigorous specimens of the variety of bean known as King of the Mountain, immediately caused withering. This micro-organism, when again isolated from these infected plants, induced withering in beans of the Great Northern variety. King of the Garden, a variety of *Phaseolus lunatus*, and Ito San, a variety of *Glycine Soja* were also infected by inoculation with a pure culture of the bacteria. The same micro-organism has been isolated from bean plants grown at Arlington and was found to reproduce the disease.

The change of colour, sometimes observed in infected bean plants appears as a pale-green, brownish-green, greenish-brown, or reddish-brown area occasionally bordered with yellow. This area is at first flaccid, but afterwards becomes dry and assumes the consistency of paper. In many cases the whole blade and petiole become flaccid and drooping, without undergoing any change of colour; sometimes part of the leaf-blade becomes soft and changes colour, while the rest of the lamina and the petiole remains turgid for a time.

The micro-organism inducing the disease is regarded as a species new to science and has been given the name of *Bacterium flaccumfaciens*. The author gives a very detailed account of the many characters distinguishing it from *Bact. Phaseoli* Erw. Smith. G. T.

652 - **Potato Diseases in Argentina.** GIROLA C. D., in *Boletín del Ministerio de Agricultura de la Nación* Vol XXVI, No 3, pp 260-264, 2 pl. Buenos Ayres, 1921.

Potato disease appears to be spreading in Argentina. In addition to "potato mould" (*Phytophthora infestans*), which has long prevailed there, causing very considerable damage, and "dry-rot of the tubers," (*Fusarium Solani*), a fairly common malady, a disease due to *Corticium vagum* var *Solani* has been reported for some years from the neighbourhood of Buenos Ayres. During the agricultural year 1920-1921, Potato scab *Oospora Scabies*, was observed for the first time on potatoes coming from Balcarce.

The author describes the characters of the two last mentioned parasites and the means of their control.

The beetle, *Epicantha adspersa* sometimes causes serious injury to the potato. G. T.

653 - ***Peronospora Trifoliorum* found in Italy on Lucerne of Argentina Origin.** — CAMPBELL, C., in *Annuale di Botanica*, Vol XV, Part 4, pp 283-284. Rome, 1922.

In the course of comparative cultural experiments carried out with lucerne seed from different parts of Italy, France and Argentina, the plot sown with Argentina seed was found, for several years in succession to be severely attacked by *Peronospora Trifolium* De Bary, whereas the other plots of lucerne, as well as those sown with species of *Medicago*, clover, *Lorus* etc., were entirely free from the fungus.

The germinating capacity of the Argentina lucerne seed when previously tested in the laboratory, did not differ from that of the seed from the other countries. G. T.



- 654 - ***Botrydiplodia Theobromae*, a Deuteromycete injurious to the Cotton Plant (*Gossypium punctatum*) in Dahomey.** — PATOULLARD, N., in *Revue de Botanique appliquée et d'Agriculture Coloniale*, Year II, No. 6, pp. 41-42. Le Mans, February 28, 1922.

Cotton plants belonging to the species *Gossypium punctatum* Schum. and Thonn (= *G. barbadense* L.) and native to Dahomey have been seriously injured by *Botrydiplodia Theobromae* Pat.

The diseased plants were stunted, bore few and malformed leaves, while the incompletely developed, shrivelled, black pods did not open. The cotton was tangled into a shapeless mass, and was often quite black and always useless.

The wood of the stem and root and also the cortex assumed an abnormal grey colour, caused by the brownish filaments of the mycelium which connect the cells.

The parasite was seen externally, on the lower part of the stem, near the root-collar, and on an oval swelling several centimetres in length, where it formed small, scattered, black tubercles which penetrated the epidermis. These tubercles are also met with on the largest branches, and cover the surface of the bolls. They become fewer and smaller as they ascend the stem, and are composed of pycnidia united by a stroma.

Should *Botr. Theobromae* continue to spread on cotton plants, it might become a dangerous pest. The disease being a wound parasite probably penetrates into the stems through the lesions produced by insects in the growing tissues. G. T.

- 655 - **Diseases and Pests of Cinnamon in Ceylon.** - - See No. 577 of this *Review*

- 656 - **The Mucedineae, *Botrytis vulgaris* on the ornamental Liliaceae, *Funkia ovata* and *F. Subcordata*, and in its latent form on Rose Bushes in Italy.** — FERRARIS T. and CIFERRI, R., in *Costa Azzurra Agricola-Istoriale*, Year II, No. 1, pp. 7-8, San Remo, January 1, 1922.

Plants of *Funkia ovata* Spreng. and of *F. subcordata* Spreng. growing in two different places have been found to be attacked by *Botrytis vulgaris* Fr.

The disease first made its appearance on the floral axes in the form of a white cotton like mould, which almost covered the axes and then spread to the leaves. The floral axes are disorganised by the mycelium, bend back on themselves and frequently become useless. The parasite then descends to the root-collar, which turns yellow and the plant dies. Slender sclerotia are seen afterwards on all the affected parts, especially of the floral axes.

Where the surrounding conditions are favourable, the mycelium spreads over the surface of the ground, and passes from plant to plant.

A latent form of the same fungus has been observed on the rose-bush. The buds of the infected plant do not fully develop, but wither and fall without the plant showing any sign of disease. The presence of the fungus was discovered by placing the buds peduncle downwards in damp sterilised sand, and keeping them under glass for some time.

The best means of preventing this disease in greenhouses is to provide good ventilation. In the case of rose-bushes grown out of doors, fairly resistant varieties should be chosen, and the permanent moisture of the soil lessened by a moderate application of mineral fertilisers. The disease having once appeared, an attempt may be made to check it by spraying with 1-2 % bisulphite of lime, alternating with the application of powdered lime (80 %) and powdered alum (20 %). It would be better, however, to burn all diseased plants immediately and to isolate infested plots.

G. T.

657 - *Cytosporina citriperda* n. sp. a Deuteromycete destructive to Mandarin Oranges, in Italy. — CAMPANILE, G., in *Le Stazioni sperimentali agrarie italiane*, Vol. IV, Part. 14, pp. 512, figs. 4. Modena, 1922

In 1922, most of the mandarin oranges offered for sale in Rome were infected with a disease characterised by the presence on the skin of a single round patch (occasionally two or three patches occurred) of a maximum diameter of one and a half centimetres. This was at first brownish-red, and later black. The spot was depressed and in the endocarp under it there developed a laminated, irregular, sinuous, almost cartilaginous formation. This formation which microscopic examination showed to be a stroma, bore on both surfaces a large number of pycnidia of a Deuteromycete belonging to the genus *Cytosporina*, said by the author to be a type new to science, to which he gave the name of *Cyt. citriperda*. From its position, and as a result of inoculation made with it, the author considers this fungus to be the cause of the disease.

Pycnidia of *Cit. citriperda* have also been observed, although rarely, on the patches appearing upon the bark.

The parasite spreads subsequently in the endocarp, where it forms new stromata, it may penetrate even as far as the centre of the fruit, sometimes actually attacking the seed.

Mandarin oranges thus affected naturally lose much of their value, especially if the patches are numerous, and the diseased portion acquires a bitter, rather disagreeable taste.

It is probable that this disease is related to that produced on citrus fruits in America by *Phomopsis Citri* Fawcett.

G. T.

658 - *Trichothecium candidum*, a Mucedinea injurious to Apples in Italy. — CIFERRI, R., in *L'Italia Agricola*, Year LIX, No. 1, pp. 16-17. Piacenza, January 15, 1922.

During the summer of 1921, the author observed that many of the ripe apples on a tree of the Reinette variety in the Marches, were covered with small round spots with a blackish-brown border bearing a whitish efflorescence in the centre. Examination under the microscope proved this to be formed by conidia of *Trichothecium candidum*, a Mucedinea well-known as a saprophyte, but apparently capable, as in the present case, of assuming the rôle of a facultative parasite. From the superficial patches, the fungus mycelium penetrated into the pulp of the fruit which resulted in a brownish rot. As a rule, the decomposition though progressive,

stopped short of the loculi; when it reached this point, the apple already brown and shrivelled, soon became mummified by the summer heat if left in its natural surroundings. In a moist chamber, on the other hand, it was speedily reduced to a soft putrescent mass of pulp which was soon invaded by moulds.

In order to prevent the possible spread of the disease, it is advisable to destroy all fruits showing any signs of this infection, to which the author has given the name of "white apple-blotch" G. T.

659 - *Dothiorella Sanninii* n. sp. a Deuteromycete causing Scab ("Rogna") on Pomegranates in Italy. — CILERRI, R. in *Il Coltivatore*, Year LVII, No. 36, pp. 569-570. Casale Monferrato, 1921.

The surfaces of some fruits of *Punica Granatum* on sale at Alba (Prov. of Cuneo), were completely covered with small black patches caused in the opinion of the author, by a Deuteromycete, *Dothiorella Sanninii* n. sp. This fungus was found to spread from one fruit to another wherever there were slight lesions of the epidermis.

It does not seem to injure the interior of the pomegranates, but as the fruit is greatly disfigured by the presence of the patches, they lose their commercial value.

Care must be taken not to store the fruits in piles, and to remove any that are affected. G. T.

660 - Fungi injurious to the American Grape in Sicily. — See No. 586 of this Review.

## WEEDS AND PARASITIC FLOWERING PLANTS

661 - The Macrolepidopteron, *Papilio leratii*, as a natural Means of controlling *Asclepias curassavica*, a Weed growing in New Caledonia. PALADINI, I. (Senoi), in *Revue agricole* No. 77, pp. 3-4 Noumea, Feb. 1922.

The seeds of *Asclepias curassavica* were introduced into New Caledonia from Tahiti about 1860 and the weed spread with such rapidity, especially in the valleys, that it infested nearly all the soil.

Some years later, the parasite had almost entirely disappeared from New Caledonia owing to the attacks of a Macrolepidopteron, called by the author *Papilio leratii*. The larvae destroy the leaves and stem of the *Asclepidiæ* upon which *Asclepias curassavica* carries out all its metamorphoses.

The author considers that the extirpation of the plant, even had it been possible, would never have given such a satisfactory result. G. T.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

662 - Biological Observations on the Larvæ of the Coleopteron, *Tenebrioides mauritanicus*. — MIGNONE, A. in *Nuovi Annali del Ministero per l'Agricoltura*, Year II, No. 1, pp. 136-141. Rome, March 31, 1922.

GENERAL

An account is given in this paper of experiments made from 1915 to 1917 with a view to determining the habits of the larvæ of *Tenebrioides mauritanicus* L. (= *Trogosita mauritanica* L.), with respect to the caryop-

sides of wheat and other cereals, which according to many authorities, are seriously attacked by these parasites. The experiments have proved that the larva, like the adult beetle is carnivorous and does not injure wheat, the larvae of phytophagous insects forming its favourite food.

G. T.

663 - **Scale Insects Observed on Orchidaceae in Colorado.** — COCKFRELL, T. D. A., in *Entomological News*, Vol XXXIII, No 5, p 140 Philadelphia, May 1922

The following scale-insects have been found at Boulder (Colorado), on *Orchidaceae* grown in greenhouses.

1) *Aonidia pseudaspidiotus* (Lindinger), on the stems of *Vanda teres* Lindley the host-plant comes from India and the scale-insect no doubt belongs to an eastern species;

2) *Chrysomphalus dictyospermi* (Moigan) infesting the leaves of *Coclogyne cristata* Lindley;

3) *Diaspis boisduvali* Signoret, on *Lachnocattleya hybr. Victoriae* (Queen Victoria Hort), and on *Odontoglossum Rossi* Lindley.

All three of these scale insects are interesting owing to the place where they were found, *Chrys dictyospermi* and *D. boisduvali* being reported for the first time as occurring on their respective hosts.

G. T.

664 - **Insects injurious to Crops in Brazil.** MORTIRA, C., in *Ministerio da Agricultura, Industria e Commercio, Instituto Biologico de Defesa Agricola, Boletim No 1* (Serie de divulgação), 152 pp., figs 25, pl 60. Rio de Janeiro, 1921.

In the above publication the author first gives a few data regarding the anatomy and physiology of insects and then mentions the principal species of agricultural pests in Brazil. The matter is subdivided into as many chapters as there are plants or plant products under discussion, e. g. citrus trees, fig-trees, *Anona reticulata* and other *Anonaceae*; sugar-cane; cacao plant, coco-nut palms and other palms; caryopides of maize and rice; beans, and coffee berries, tobacco; rice (plant); cotton plant, guava plants and other *Myrtaceae*; kitchen-garden plants, vines and coffee; shrubs and those of commercial value ornamental trees. There are also special chapters dealing with locusts, fruit-flies, Forficulidae, the two beetles popularly known as "vaquinhas," which destroy fruit trees (*Macroductylus suturalis* Mannh. and *Epicaula atomaria* Germ), with aphides and scale insects, and with control measures, especially insecticides.

The author describes the stages of development and the habits of the most important insects considered in each chapter, and gives an account of the methods of control which may be used against them.

G. T.

665 - **The Introduction into Italy of the Hymenopteron, *Aspidiotiphagus lounsburyi*, an endophagous Parasite of the "bianca-rossa" of Citrus Trees (*Chrysomphalus dictyospermi*)** (1). — PAOLI, G., in *Il Coltivatore*, Year LXVIII, No 15, pp 451-455, figs 2 Casale Monferrato, May 30, 1922.

The chalcid hymenopteron, *Aspidiotiphagus lounsburyi* Berl. and

(1) See also R Jan 1918, No 118 (Fd)

Paoli is well-known in Madeira. This insect is an endophagous parasite of the Coccid, *Chrysomphalus dictyspermi* Morg ("bianca-rossa" of citrus trees), which is also very common in the island, and is found on many widely differing species of plants.

In March 1922 the author was sent to Madeira by the Italian Ministry of Agriculture to collect leaves attacked by "bianca-rossa." This insect was infested by the internal parasite, *Ispidiotiphagus lounsburyi*. These leaves were taken to Italy, some were placed in gardens at Chiavari (Prov. of Genoa) and others in Sicily where the coccid occurs in great numbers.

Part of the material was kept in the laboratory, and the insects which hatched out daily in hundreds from the leaves under observation, were at once set at liberty in the various gardens.

The author is of opinion that *I. lounsburyi* will become acclimated in Italy without any difficulty.

G A

666 - **South African Maize Pests.** See No. 565 of this Review.

INSECTS, ETC.  
INJURIOUS  
TO VARIOUS  
CROPS

667 - **Pests of *Sorghum vulgare*, in India.** See No. 566 of this Review.

668 - **Insects injurious to Sainfoin in Sicily and Tunisia.** — DI STEFANI, I. in *Annali mensili* Year III, Part 3, pp. 85-86 (Palermo, March 1921).

In Sicily and Tunisia during the past few years the crops of sainfoin (*Hedysarum coronarium*), have been attacked by *Sphinctoplera lineata* Fabr. and *Sph. laticollis* Oliv.

The author gives a short account of the life cycle of the former which is entirely passed within the host plant. Both the Buprestid beetles, when in the larval stage excavate a deep gallery in the tap-root of *Hedys. coronarium*, and do irreparable damage to the plant.

The individuals that are attacked can be easily recognised as their leaves first wilt, and afterward wither. Both the beetles have increased to a greater extent in each successive year. The injury done recently by *Sph. lineata* in the territory of Monreale (Prov. of Palermo) was so serious that the young sainfoin seedling were entirely withered throughout wide areas, while the colonists in Tunisia fear that they will have to give up growing this crop owing to the attacks of *Sph. laticollis*.

*Hedysarum coronarium* is not only injured by the above two Buprestids, but also by the larva of a Macrolepidopteron, *Sesia ichneumoniformis* S. V., which likewise infests the tap-root of the Leguminosa.

In the control of these insects good results could be obtained, according to the author, by uprooting and burning in February, March and April all unhealthy looking plants of sainfoin, as their diseased condition is most probably due to the mining of the tap-root by the larvae.

G T

669 - ***Heliothis armigera* (Cotton boll-worm) a Macrolepidopteron causing Damage in ratooned Cotton fields in South Africa.** - See No. 572 of this Review.

670 - *Homalonotus coriaceus*, a Coleopteron injurious to the Coconut Palm in Brazil (1). — BONDAR, G., in *Chacaras e Quintaes*, Vol XXV, No 3, pp 205-208, figs 5  
São Paulo, March 15, 1922

In Brazil there are large numbers of coconut palms bearing crops much below the normal minimum, which instead of producing over fifty nuts per annum yield only from ten to twenty. In place of the twelve annual bunches each containing ten to twenty nuts, four or five bunches only with three to four nuts each, attain maturity. The others either die prematurely before the fruit sets, or lose the greater number of their nuts before they are fully developed or ripe.

The abortion of the fruit is due to a Curculionid beetle, *Homalonotus coriaceus* Gyll.

The adult individuals hide themselves in the axils of the leaves near the inflorescences, and live on the internal tissues of the palm.

In order to reach the flowers that have not yet unfolded, the insect actually perforates the spathe enveloping them. Many of the flowers thus attacked die, and when the spathe is perforated in ten or fifteen places, all the blossoms it contains perish. This is, however, exceptional, as a rule only some of the flowers are destroyed by the attacks of the Coleopteron.

When the surviving flowers produce fruits, these are perforated by the insect which sucks out their contents. This causes the abortion and fall of the young nuts. Frequently 4 to 5 holes are to be seen in the fallen nuts, usually at the extremity of the fruit.

The beetle lays its eggs on the palm, choosing by preference the spathes where it finds its food supply. Each egg is deposited in a cavity made for its reception in the median part of the spathe, which acts as a sheath to the peduncle of the inflorescence.

The larvae live on the tissues of the spathes and then pass to the more tender and succulent peduncle of the inflorescence excavating a groove as they descend the stipe. The nutrition of the flower and fruits is thus hindered, and in consequence the nuts fall. Often the whole peduncle of the inflorescence is attacked, so that it dies and all the nuts are lost. When the larva attains its full development before reaching the base of the peduncle, it weaves a cocoon in the cavity of the spathe, using the tissues of the plant itself for this purpose. In this cocoon the beetle pupates and remains until it attains its adult form.

When several larvae descend into the peduncle, or if the peduncle dies before the enclosed larva has completed its development, the grub passes into the stipe, which is still covered with leaves, and there bores a gallery 20 to 30 mm in diameter.

The best means of controlling the insect is to catch the adults that usually hide in the axils of the leaves, all dead or injured inflorescences should be cut back as far as possible, and the insects found on them must be destroyed.

G T

(1) See R. Sept 1915 No 991 (Ed.)

671 - **Pests of the Cacao in Grenada.** — See No 576 of this Review.

672 - ***Glyphodes unionalis*, a Microlepidopteron destroying Jasmine in the Department of Var.** — BERLAND, L., and SEGUY, E., in *Bulletin de la Société entomologique de France*, No 7, pp 95-96, fig. 1. Paris, 1922

In September 1921, at Callian in the Department of Var, much damage was done by a caterpillar to the plantations of jasmine, a flower grown on a large scale for the extraction of perfume.

The caterpillar feeds upon the leaves of the plant, and also bores a hole about half-way down the corolla tube of the flower, generally causing the flower thus attacked to wither quickly.

Some of the caterpillars collected on the spot were reared; they pupated from the 8th to the 10th of September. On the 10th of the same month, there emerged from them a fairly common Microlepidopteron, *Glyphodes unionalis* Hübner, better known owing to the injury it does to the olive-tree, but also occurring as a parasite of the jasmine, *Ligustrum* sp. and *arbutus*.

Some apparently healthy caterpillars did not make chrysalides, but produced pupae found beside the contracted body of the caterpillars. From each of these pupae on September 19th there emerged the adult form of a parasite of the Microlepidopteron, the tachnid *Zenillia roseanae* B. B. of which the authors give a description.

It is probable that in the territory of Callian this tachnid will act as a sufficient check upon the Microlepidopteron, but it may not prove as efficacious in the neighbourhood of Grasse, where the complaints of the horticulturists are continually increasing. G. T.

673 - ***Eriophyes* spp., Mites injurious to the Fruits of the Fig-Tree and of *Rubus*, new to California.** — ESSIG, E. O., and SMITH, E. H., in *Monthly Bulletin of the Department of Agriculture, State of California*, Vol XI, No 1, p. 63. Sacramento, California, January 1922

Two new *Eriophyes* injurious to cultivated plants were discovered in California during the summer of 1921.

The first was a species of *Eriophyes* which appeared to be common in the valleys of the interior of California. It lives on the fruits of the different varieties of fig-tree, "Dottato" or "Kadota," "Calimyrna" and "White Adriatic"

The mites are found in all stages of the unripe fruit and their presence is shown by a whitening of the bracts and pulp in the neighbourhood of the apical opening. On cutting open one of the figs there are seen in the pulp certain spots and striae, radiating from the apical opening. These are often translucent and prematurely pink or brown, according to the degree of ripeness the fruit has attained. Large numbers of mites are always present in these spots and on the yellowing bracts, as well as in the normal pulp. They are most numerous in the half-grown, or nearly full-grown figs. As the figs ripen, the mites gradually change their position and are to be found only under the small bracts at the apical opening, when the fruit is quite mature.

How far this mite is responsible for the changes described is not yet known. According to the authors this Eriophyde had never before been met with on fig-trees either in California or elsewhere.

The second species of *Eriophyes* occurs on the green and the ripening fruits of *Rubus* var. Himalaya. This mite produces a definite change in the fruit which prevents it ripening, or else causes the drupels to ripen irregularly, so that some may be still green while others are quite ripe and black. The mites cluster chiefly round the centre of the fig and at the base of the drupels. This species of *Eriophyes* had never been seen before, although the damage done to the fruits of *Rubus* Himalaya (the only variety that appears to be attacked) had been noticed for many years and attributed to animal agency of another kind.

G. T.

674 - Pests of the Date-palm in Mesopotamia. Sec No 554 of this *Revue*

675 - Observations on an Affection of the Date Palm known under the name of "Doud" in North Africa. SURCOUT J M R, in *Bulletin de la Societe d'Histoire naturelle de l'Afrique du Nord* Vol XIII, No 2 pp 31 35 Algiers, February 15, 1922

The affection of the date-palm known as "doud" has spread to the knowledge of the author, from the district of Figuig in Morocco, to El Goléa and Touggourt, it is well-known to the natives who attribute it to the attack of beetle larvae

Some authorities do not consider that "doud" is entirely due to the agency of these insects but the author's researches carried out in various parts of Algeria from 1917 to 1921, have shown it to be coincident with the presence of beetles in the leaf-crown of the palm. The species which occur in the largest number are *Phyllognathus vlenus* and *Oryctes bispinosus*

In the author's opinion, the affection is due to lesions produced both by the adult beetle and the larva, but chiefly by the latter

G. T.

676 - The Fir-Needle Beetle (*Polydrosus pilosus*), in Switzerland. — BARBEY, A., in *Journal forestier suisse* Year LXXII, Nos 10 11, pp 186 189, 1 pl Berne, 1921.

The curculionid beetle, *Polydrosus pilosus* Gredl., was observed for the first time at the end of May and early in June 1921, in the forests of the Canton of Vaud on the White Pine, as well as upon the Spruce and certain deciduous shrubs. In the case of the White Pine, naturally sown seedlings were attacked when four years of age when they had attained the height of ten centimetres, as well as trees three to four metres high. The beetle wandered over the branches, eating the scarcely developed leaves, those near the tip being preferred

There is good reason to believe that the insect had appeared the preceding year, but in such small numbers that its depredation escaped notice

The spikes and terminal buds seem immune from attacks of the beetle, though the growth of the tree is arrested to some extent as a result of the partial stripping of the leaves.

G. T.



677 - The Grey Pyralis of the Larch (*Steganoptycha pinicolana*), injurious to the Siberian Pine and the Mountain Pine, in Switzerland. — BADOUX, H., in *Journal forestier suisse*, year LXXIII, No 1, pp 1-6, 1 pl. Berne, January 1922.

Since 1858, *Steganoptycha pinicolana* Zll. (= *St dimiana* Gn.), has periodically attacked larches in the plantations of Grisons and Valais. It in its larval stage this insect devours the leaves in larch stands of all ages, and arrests the growth of the trees to a very considerable extent.

Although this Microlepidopteron lives chiefly on the larch, it is not strictly monophagous. Most authors however regard its presence on other forest trees as exceptional. COAZ, NÜSSLIN and BARBIY seem to consider that the Spruce, Siberian Pine and Mountain Pine are attacked only by *St pinicolana* when growing in a plantation of infected larches.

Observations made during the summer of 1921 have shown that the larch pyralis is injurious to other trees besides *Larix*.

In several parts of Grisons, both the Siberian and the Mountain Pines, generally regarded as vigorous and immune to insect attack, were found to be infested over a large area by a caterpillar recognised as being the larva of *St. pinicolana*, while nearly all the larches in the same neighbourhood were free from the pest.

G. T.

678 - Damage caused by the "White Fir Beetle" (*Pissodes piceae*) in Switzerland. — BADOUX H., in *Journal forestier suisse*, Year LXXIII No 4, pp 68-69. Berne, April 1922.

*Pissodes piceae* Ill. occurs frequently in Switzerland, but seldom does any appreciable damage.

In 1921, this Curculionid beetle made its appearance in the forest of Engelberg (Aargau) in a plantation of firs that had been greatly injured by the attacks of *Dreyfusia nüsslini* C. B.

The appearance of the beetle has recently been reported in a forest belonging to the Commune of Lichtensteig (St. Gall). About twenty average sized timber fir trees have been attacked and it has been necessary to fell them. An examination of the wood has shows the presence of *Sirex gigas* L. as well as of *Pissodes piceae*.

In order to prevent the propagation of both the Coleopteron and the Hymenopteron, all trees harbouring any of the beetles should be felled at once and the bark stripped off. All fragments of bark in which the insect has deposited its eggs must be burnt.

G. T.

[677-678]



INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

679 - **Report of the California Department of Agriculture for the Period ending December 31, 1921.** — HECKE, G. H., in *The Monthly Bulletin, Department of Agriculture, State of California*, Vol. X, Nos. 11-12, pp. 559-569. Sacramento, Ca., Nov-Dec 1921

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

The general agricultural depression following the war has probably been felt to a lesser extent in California than in most parts of America, this being due largely to the excellent organisation of the co-operative marketing associations and of the prominent independent commercial concerns. The year 1921 has been exceedingly important from the point of view of agricultural and horticultural legislation. Some of the decrees established have meant the addition of entirely new activities to the work of the Department, for example the Pure Seed Law authorises a much needed standardisation of agricultural seeds and a Seed Testing Laboratory is now established in co-operation with the United States Bureau of Plant Industry.

As regards the new laws affecting the livestock industry, the most important are the co-operative systems relating to tuberculosis which are under control of the Federal State.

The centralisation plan has now been completed and the diagram illustrates the present organisation of the State Department of Agriculture. The recent addition of the Department of Weights and Measures and the State Market Commission and Fish Exchange has resulted in broadening the scope and activities of the Department. The important steps taken with reference to Standardisation, Pest control and quarantine etc. are dealt with under the various sections. These reports of

[Abstract No. 679]

the different division leaders demonstrate the marked development, in every case attributed to the loyal co-operation of the various agencies concerned.

#### DIVISION OF PLANT INDUSTRY.

*Bureau of Pest Control* — Activities have been continued along the following lines:

a) Regulation of traffic in walnuts to control the spread of codling moth (1);

b) Investigation of the possible improvement in the treatment of nursery stock to prevent the transport of certain insect pests. Work carried on by the Bureau includes treatment of apple, pear, peach, plum, almond, apricot, cherry, olive, orange, grapefruit and lemon. A number of standard liquid insecticides and fumigants were used, applied under vacuum conditions. Results have furnished a basis for the development of methods which should prove very helpful with reference to a number of present day problems. Special work has been undertaken with citrus nursery stock, which was first defoliated, then treated with hydrocyanic gas for 1 hour under reduced-pressure conditions (ratio 1.03. sodium cyanide to 100 cub ft. in a 27 inch vacuum) This method proved very successful in the destruction of red scale (2),

c) Control of insects affecting dried fruits. Satisfactory reports have been received from fig, date and raisin packers after their installation of fumigators. Experiments have been made with a view to ascertaining the value of fumigation of dates in vacuum with sulphur dioxide and their resistance to such treatment without commercial injury. In various experiments gas was generated by the utilisation of pure liquid carbon bisulphide at varying strengths. No injury was evolved from the standpoint of excess residue.

Reports as to the designs put forward for the fumigating apparatus are given, but all work of this kind should be considered of a preliminary nature.

d) Investigation as to the possibility of a satisfactory treatment of potatoes to destroy tuber moth (3). Complete details of the work done will be presented in a special report.

e) Work with the California Almond Growers' Exchange, in connection with the control of insect pests of almonds. The Indian moth (4) has been a constant source of trouble in the packing houses. A successful treatment has been effected to eradicate this pest, namely the application of heat to the infested part of the building. The details of the procedure are given.

f) Sterilisation of picking boxes. The treatment by steam to destroy pests has met with considerable success.

g) Grasshopper poison.

(1) *Carpocapsa pomonella* — (2) *Chrysomphalus aurantii*. — (3) *Phthorimaea operculella* Zell — (4) *Plodia interpunctella* Hbn (Fd)

*Field work in Insect control.* — Attention has been turned especially to the control of the following pests : — Strawberry root weevil (*Otiorynchus rugifrons*) ; strawberry leaf weevil (*Paria canella*) ; pear thrips (*Euthrips pyri*) ; pear mealybug (*Pseudococcus maritimus*), etc.

The introduction of the South African black scale parasite (*Aphiscus lounsburyi*) is very evident, and a systematic distribution as well as the development of further quantities of this parasite has been in progress. Other beneficial insects are also reported, amongst them the Citrus feeding mealybugs, *Cryptolæmus montrouzieri*, the Sicilian internal parasite, *Tanaomastix abnormis*, the Cotton cushion scale predator, *Vedalia cardinalis*. Experiments are also in progress in connection with red scale parasites and the Coleopteron steely-blue ladybird (*Orcus chalybeus*), *Rhizobius lophanthrac* and *Chilocorus bimaculatus* have already given good results. The Chalcid, *Aphelinus diaspidis* is also under close observation. Rodent control work has been prosecuted vigorously throughout the State and an intensive campaign against coyotes and other predatory animals has been inaugurated. Full details relative to these points are given.

#### BUREAU OF STANDARDISATION

a) *Fruit and Vegetable Service* -- At present this Bureau is engaged in the determination of workable standards for grapes and other deciduous fruits.

b) *Port inspection service of fruits and vegetables.* — This service places at the disposal of growers and shippers of perishable products, expert, disinterested, official inspectors from the Department of Agriculture who issue certificates covering the carload as a unit.

The seed potato certification service has been extended and enlarged during 1921, and also the grain and warehouse inspection service and the seed standardisation and inspection service.

**BUREAU OF PLANT QUARANTINE.** — In addition to the maritime port inspection, activities have been extended to the inspection of automobile traffic, a new field in quarantine work and one which should be given full consideration in the future. Quarantine orders have been revised so as conform to changing conditions brought about by the spread of pests and diseases in other States.

**REPORT OF THE VITICULTURAL SERVICE.** — Details are already published in the Annual Grape Report and data relative to economic returns will shortly be published by the California Crop Reporting Service of the State Department of Agriculture.

Data is given relative to the frost damage to the 1921 grape yield.

No further progress has been made as regards control of diseases and pests. The nematode *Heterodera radicum* (potato eelworm) has caused serious damage lately.

Grape phylloxera (*Phylloxera vastatrix*) is prevalent and widespread throughout the State, and the most effective methods adopted are : 1) the grafting on resistant roots when the soil is susceptible to phylloxera infestation ; 2) planting in very sandy soils or loams not susceptible

to infestation. All other practices offer little guarantee of longevity. The hot water treatment of rooted vines and cuttings when applied with care is effective as an agent of disinfection and if universally adopted would undoubtedly retard attack and restrict the spread of this disease. The Federal quarantine regulations although causing inconvenience to vine growers by barring the use of rooted vines and consequently delaying the planting of vineyards, is an advantageous institution in that it is a safe measure of protection against the introduction of pests and vine diseases which if once acclimatised would be so costly to control that vine cultivation would be restricted to the more highly profitable localities.

**DIVISION OF CHEMISTRY.** — A comprehensive inspection service has been inaugurated relative to the manufacture and sale of materials used in the control of diseases and pests, weeds and rodents, the last two of which have not hitherto been covered by any law.

A co-operative arrangement has been effected with the Division of Animal Industry and the Division of Chemistry for the equipment and operation of a laboratory for the bacteriological and chemical examination of dairy products.

An inspection service has also been at work for the administration of the Fertiliser Law. Briefly stated, the activities of the Division are now as follows :

1) Administration of Fertiliser Law : — a) Registration and licensing of manufacturers and dealers ; b) collection of tonnage taxes ; c) sampling and analysing of all brands of commercial fertilisers offered for sale, and publication of the results ; d) prosecution of those who sell commercial fertilisers without license or payment of tonnage taxes ; e) prosecution of those who sell labelled commercial fertilisers below the guaranteed analysis ; and of those who sell animal manures containing added sand or water.

2) Administration of the Economic Poison law : — a) Registration and licensing of manufacturers and dealers sampling and analysing substances offered for sale in the State to be used for the control of insects, fungi, weeds and rodents and publication the results ; c) prosecution of those who sell economic poisons without license ; d) prosecution of those who sell adulterated or misbranded economic poisons.

3) Chemical and bacteriological examination of dairy products as required by the Dairy Service of the Division of Animal Industry.

4) Testing and certification of all instruments used by creameries to determine the percentage of butter fat in milk and cream.

5) Analysis of miscellaneous substances required by other Divisions of the Department

This has included the analysis of fruits for the Bureau of Standardisation, and toxicological examinations of stomach contents of various organs of cattle and other live stock, feed and water, in suspected cases of poisoning.

6) Testing of instruments and supplying standard solutions for

all County Horticultural Commissioners, test determination for the ripeness of oranges, and instruction of officials and their deputies and inspectors in the technique of making the so-called 8 to 1 test.

7) Public service: a) Official and private analyses of economic poisons, fertilisers and allied substances, such as agricultural lime, gypsum and so called soil stimulants.

b) Analysis of milk and cream for industrials.

c) Correspondence, personal visits and conferences pertaining to the above-mentioned activities.

d) Investigations: — a) Chemical and bacteriological investigations to improve the quality of dairy products and to prevent and detect fraud.

b) Chemical investigations to obtain information when needed for the enforcement of the various laws.

**DIVISION OF ANIMAL INDUSTRY.** — In addition to the important laws affecting the live stock industry concerning tuberculosis eradication, disease investigations have been in progress and certain diseases such as the Texas fever tick and sheep scab have been reduced to a minimum. A list is given of the various diseases investigated and the eradication results.

Data are given concerning Dairy Inspection work, cattle protection service and cattle statistics, and the newly-established meat inspection law.

**DIVISION OF WEIGHTS AND MEASURES.** Inspections have been made in the various counties, cities and towns of the State in respect to weights and measures, to the sale of goods, wares, merchandise, commodities and foodstuffs in containers. These inspections are made in the various localities during their busiest seasons. Each state institution is inspected at least once annually and all scales, weights and measures are tested and corrected, which enables an accurate check to be made on incoming supplies. Further details are given with reference to the work of the "public weighmasters", the Net Container Law, *i. e.* the marking of containers with net quantity of contents; the gasoline and oil measuring devices; bread standardisation etc.

**DIVISION OF MARKETS.** — The efforts of this division have been concentrated largely on the proper and equitable distribution of the food supply. A survey of activities during the latter part of 1921 is made.

*Crop Report for 1921, and final estimates of acreage production and value of the principal crops of the State of California* — The tables in this report summarise the production of the various crops. Revised figures on acreage and production for 1919 and 1920 are included for comparative purposes.

680 — **Review of the Agricultural Situation in North West Morocco.** — SAULNIER, J., in *Revue Agricole de l'Afrique du Nord* Year 19, No 75, pp 10 13 1 map Algiers, 1921

The "Gharb" area under discussion, occupies the whole of the North Wets of French Morocco. Bounded on the north by the Klott, on the south by the Béni-Hassen area, on the east by Djebala and Riata and on the

west by the Atlantic Ocean, this region forms an immense plain with the Chatba Mountains as a central ridge running from west to east.

Three types of soil quite distinct from each other are to be found, namely: — 1) Sandy soils ("rimet"); 2) black soils ("tirse"); 3) white soils ("desse"). The sandy soils are prevalent in the northern section of the area. Beneath the surface soil is found a layer of blue clay containing traces of glauconite, and below this, sand again, and then gravel. It therefore belongs to the Upper Pliocene group, and is especially noticeable in the Maarif and Anabsa plains. The comparatively pure sand extends as far as Oued Bon Harira, but further south the colour changes to black, perhaps owing to the abundance of humus. Here and there in the sand, if the clay layer is at all deep, marsh ("merdja") formation is obvious, and this formation is associated with almost the entire coastal area (*merdja rassed daoura*) and in certain portions inland (*merdja marktane*). The marshes are to a large extent dried up in the summer.

Further South, in the mountainous region of Chatba and Djebel Dail, there is a variation of black, sandy, whitish and greyish soil. At Aïn-el-Gsob, certain molluscs have been observed, and varieties of *Pecten jacobus* and *Ostrea* spp. (Pliocene). Dwarf palms are to be found over a limited area.

On the mountain spurs, the black soil extends to within 2 or 3 km of Oued Sebou, where it is replaced by white soil of a very colloidal nature.

CLIMATE. — The temperature of the 'Gharb' is very mild, snow is scarcely ever seen in spite of the neighbouring high altitudes (Dj. Alem. 2300 m.; Dj. Iziren. 2500 m.) The rainfall is fairly regular, and the atmosphere comparatively moist, as a result of the situation of the country near the sea and the N. W. winds.

AGRICULTURE. — The soil in the extreme north is unsuitable for cultivation and only small quantities of barley and sorghum are grown for local consumption. Wheat is cultivated only on the border of small oueds, where alluvium deposits occur. In the Maaref and Anabsa plain, where humus is combined with the sand, melons, water melons, and gourds are grown.

On the Chatba Mts. cultivation is met with only in the hollows of the foothills. On black soils of the Souk-el-Arba and Daouia plain, the chief crop is wheat, and the native activity is more marked. Further south on the Sebou white soil areas, very large tracts are covered with wheat and barley.

As regards the quality of the crops, it is noted that the wheat is frequently very fine on the black soils; durum wheat is rarely seen; the barley is also of good quality but not equal to the wheat. Fungous diseases are rare, rust and smut have been noted in a few instances.

LIVESTOCK. — The chief interest of the native from the agricultural standpoint is bound up in stock raising, more especially in the north. Special attention is paid to cattle raising, and then to horses, sheep and pigs.



*Cattle.* — These are of medium size ; certain remarkably fine specimens exist, particularly amongst the bulls. The colour varies, generally from red to deep black. Stock raisers concentrate their attention both on butcher's stock and working animals ; the first remain inactive in herds. At about 2 years old, the natives proceed to castrate, following a somewhat crude method (" *martelage* ") (doug): they beat the testicles of the animal with a switch, until they are reduced to pulp. The animal becomes feverish for a few days after the operation, and then recovers its equilibrium and fattens rapidly. Only on a few occasions has death occurred as a result of this method. No shelter is given to the animals ; they are merely enclosed in a large dug out (" *asses* "), made in the form of a regular trapezium to prevent escape.

Up to the present, stock raising has been left entirely in the hands of the natives, the Europeans merely purchase the animals and leave them in the care of the natives and take no further responsibility. The following form of contract is in vogue.

" The native takes  $\frac{1}{3}$  of the profits, is responsible for stolen beasts, and if one dies has no right to cut up the animal before the European owner has seen and investigated the cause of death etc. (This latter condition has scarcely ever been included in the contracts between the natives themselves) The European takes  $\frac{2}{3}$  of the profits.

*Milk cows.* — These are of superior quality, and give from 4-5 litres of milk per day. Cows from Southern Morocco are not often transferred to the North, as the change of conditions has a deleterious effect on such animals, the death rate amounting to 60 %. Some difficulty is found in distinguishing northern and southern animals on the market. The natives consider that they can distinguish them by the teeth, but this is doubtful. Certainly on the Gharb markets, these animals are extremely thin.

*Sheep.* — Sheep raising is especially developed on the banks of the Sebou. The animals are well made and stand high, resembling closely the merino sheep, but the wool is much less waved. The wool is generally of quite good quality. When improved, the Gharb breed should prove more profitable even than it is at the present time.

*Horses.* — The animals are of medium size, the colour varies, and no particular colour can be said to dominate. The natives completely misunderstand the castration of horses. Horse breeding is not extensively practised, but following ancient custom all who can afford to do so buy a single horse or mare, and breeding is confined to these strictly limited lines.

In Souk-el-Arba, a remount dépôt exists consisting of 10 Algerian stallions. The native horse is feeble and resembles more the draught-horse than the Algerian type. It is known by the natives as " *caïdai* " or pack-saddle horse.

Further exploitation in horse rearing will certainly be forthcoming, owing to the extensive pasture land in the Gharb area.

*Pigs.* — It appears that even before French influence existed in

the Gharb, pig rearing was a native custom. At present the same method is adopted of confiding the care of the animals to the natives as is with cattle, and a similar division of profits between European and natives. At present, two or three large exploitation schemes are being carried out and pigs are being raised in large numbers, and the future looks decidedly promising.

**TRADE** — Trade has reached a comparatively advanced stage. The chief markets are situated in Lala Mimouna or Jemao and Souk-el-Arba. The cattle trade is most important, although sheep are to a certain extent dealt with. Development in trade is dependent on stock breeding.

**INDUSTRY** — This is almost non-existent in the Gharb. The only purely local industry lies in the manufacture of the *gelabas*.

**POLICE AND LAW** — Two military posts are in existence, at Sebou and Arbaona, situated near Klott. These contain information bureaux from which officials are sent to inspect and control the local "caids", which form the native law courts.

In conclusion, the author expresses the opinion that there is a great future for the Gharb region especially on the completion of the Tangei Fez line as it is one of the most interesting districts in Morocco. Agriculture which up till now has not made any distinct progress should shortly make decided advances provided that energy is shown in the introduction of modern methods.

M L Y

**681 - Agriculture in Sergipe (Brazil). Note from the President, Dr. Jose Joaquim Pereira Lobo (1).** *Mensagem apresentada à Assembléa Legislativa, em 7 de setembro de 1921 ao installar-se a 1ª Sessão ordinária de 1ª legislatura, pelo Coronel Dr. José Joaquim Pereira Lobo, Presidente do Estado* pp 17 + tables 21 (besides text) Aracajú, Imprensa Official 1921.

Note from the President of Sergipe, Dr J J PEREIRA LOBO addressed on September 7, 1921 to the Legislative Assembly, on the occasion of the opening of the 2nd Session of the 14th Legislature, which is concerned especially with the political and economic situation. Certain extracts have here been made of outstanding importance and giving a general idea of the agricultural conditions and hygienic arrangements in this State.

**AGRICULTURE AND STOCK RAISING** — The evident importance attached to agriculture in Sergipe is demonstrated by the export data which chiefly concern farm products.

(1) For Development of Agriculture in Brazil see R June 1921, No 592 R July 1921, No 700 R Nov 1921 No. 1078, R Feb 1922 No 135. Also *International Institute of Agriculture, International Review of Agricultural Economics* Yr XII, Nos 1-2, Rome, Jan Feb 1921, containing an important bibliographical record. The following references are worthy of note. Armand LEDENT *Organisation Agricole au Brésil*, Antwerp Laporte and Doussard 1913 — Notes on institutions established by the Federal Government, in support of agriculture stock raising and agricultural industries — Dr Idelfonso SIMÕES LOPES, *Economical Notes on Brazil* Ministry of Agriculture, Industry and Commerce, Rio de Janeiro, Villas Boas V C 1921 (1d).

In 1918, the exports amounted in round figures to 22 million *milreis* (1 *milreis* = 2 $\frac{1}{2}$  at par); in 1919, 21.3 millions; in 1920, 10.4 millions.

In 1920, 93 % consisted of the following products: sugar (14 625 tons); cotton yarns (1501 t), cotton (770 t); rice (3374 t); salt (17 127 t); skins, salted or dried (245.4 t), sugar comprised 53 % and cotton yarns 31 % of the total value of exports.

Several sugar factories are in existence, the most important being the "Engenho Central de Riachuelo", the third largest in Brazil; — others are stationed at Aracajú, Estancia, San Christovan, Villanova, Propriá, and in addition to these are several other less important concerns.

The Government endeavours to encourage cotton growing (1) by the distribution of selected seed, etc., this crop however owing to the existing cotton crisis, is on the downward grade, and in 1921, the estimated yield showed a decrease of 40 000 bales of 75 kg below the preceding year, that is a ratio of 1 : 3.

The recent visit of the Cotton Commission under the direction of Mr. A. S. PEARSE (2), brought into evidence the excellent quality of the Sergipe cotton, attributed to the length of the fibre. According to the report of the Commission, the "Riqueza" or "Veidão" is the best quality cotton in the State: the fibre is 38 mm in length, strong and superior texture, very resistant to the "lagasta rosea" (*Pectinophora gossypiella*). Seed sorting is practised as a preventive measure against this pest. At present there are 72 ginneries containing in all, 48 sorters and 28 gins for cleaning purposes.

In 1920, 8 cotton fabric factories in the State had utilised 80 % of

(1) See 1) Ministério da Agricultura, Industria e Commercio, Decreto No 14 117 de 27 de março de 1920 (Cria o Serviço do Algodão), Rio de Janeiro, Imprensa Nacional, 1920 — 2) Ministério da Agricultura, Industria e Commercio, Serviço do Algodão, Relatório apresentado ao Dr. Idelfonso SIMÕES LOPES, Ministro da Agricultura, Industria e Commercio, pelo Agonomo William W. COELHO DE SOUZA, Superintendente do Serviço, Rio de Janeiro, Papelaria Americana, 1920 — 3) Ministry of Agriculture, Industry and Commerce, Board of Information, Possibilities of Cotton Culture in Brazil, by W. W. COELHO DE SOUZA, Rio de Janeiro, Papelaria, Brazil, 1920 — 4) Ministério da Agricultura, Industria e Commercio Serviço de Informações, A cultura do algodoeiro no Brasil, pelo agronomo W. W. COELHO DE SOUZA, Rio de Janeiro, Imprensa Nacional, 1921 — 5) Sociedade Nacional de Agricultura, Missão Internacional algodoeira, sua recepção nas regiões de agricultura, Conferência do Sur A. S. PEARSE, Rio de Janeiro, Typ. Revista dos Tribunaes, 1921 — 6) A. S. PEARSE, Brazilian Cotton, Manchester, Taylor Garnett Evans and Co., 1921 illustr. — 7) Dr. Deodécio DE CAMPOS, Delegate of Brazil, Rapport sur la Statistique du Coton présenté à l'Assemblée Générale au nom du Comité Permanent, Rome, International Institute of Agriculture, 8 May 1922 — 8) Prof. Umberto RICCI, La Conférence cotonnière mondiale de Liverpool et Manchester, Int. Inst. of Agriculture, Bureau of Statistics, VIIth General Assembly, 8 May, 1922 — 9) Dr. Deodécio DE CAMPOS, La Conférence internationale cotonnière de Rio de Janeiro (Oct. 1922) Communication presented to the Permanent Committee, Int. Inst. of Agriculture, 31 Mai 1922. — 10) Dr. Deodécio DE CAMPOS, O Algodão no Brasil e a Conferência mundial algodoeira de Nova-Orleans, Rome, June 1922 (Ed.)

(2) See R. Dec. 1921, No 1220 (Ed.)

the production, i. e. some 48 000 bales of 75 kg. To encourage cotton growing, the President has put forward the following propositions: 1) To fix by decree the official types of cotton, handing over the classification to the care of a competent expert, and charging the Inspection of Agriculture with the taxation, the grading and the selection; 2) to exempt for ten years from the tax on manufactures where municipal authorities have installed a first quality hydraulic press capable of reducing a bale of 180 kg to a maximum volume of 0.35 cub. m.; 3) to extend this exemption also for 10 years, and from the export tax for 5 years to the first factory which shall be established in the State for: fine thread (no. 24 and above); English thread, the weaver adapted to these threads, bleaching, tinting, preparation etc., the threading machine, weaver or other up to date method suitable for the manufacture of flannel; the Government being obliged to contribute 20 % towards the expense of installation, and to exempt from the tax on manufactures for 10 years the ginneries which are employed for seed sorting and commercial grading.

*Rice cultivation* is still limited to very primitive methods, and consequently the yield varies from year to year.

*Tobacco, maize and coconuts* hold an important place, and the export of these products steadily increases. It may be estimated that as much as 2647 hl. of vegetable oils were exported in 1920.

The Government encourages the farmer, by the distribution of imported machines and agricultural implements, at cost price and free from customs charges. At the "Centro-Agricola", several crops are on trial: manioc, maize, forage crops, etc. and also at the "Horto botânico". The "Zootechnological Postes" has received a subsidy of 50 000 *milreis* (1920) for improvement purposes, this "posto" is an important asset in connection with stock raising, and is a recognised resort of animal breeders. The export of hides and skins has been on the increase for several years.

*Lines of communication.* — The lack of communication continues to render stationary the economic situation. It appears probable that once the obstructions at the mouth of the river Japarutuba are removed, the immense valley, where the land is particularly fertile, could be utilised; already several factories are established there. This scheme, which has been submitted for approval to the Chamber of Deputies, would render the river navigable, and would keep back the floods, which each year, cause destruction over a wide area planted with sugar cane, and would permit the cultivation of immense areas.

*Education.* — Sergipe State possesses at the present time not counting the numerous free establishments — 271 institutions: the "Athenas Sergipense" a secondary school for boys; the "Escola normal" for teachers providing a course covering a period of 4 years; 7 evening schools for adults. The State Primary schools are increasing slowly; in 1921, in the whole State there were 7855 pupils of both sexes. The illiterate are in the majority. The President proposes to add to the girls' section of the schools, a second year for children who do not

pass on to the normal school for teachers, and who have the wish to qualify in domestic management typewriting, needle work music, etc

*Sanitary conditions* — The population is on the decrease due chiefly to emigration

The sanitary arrangements are still open to much improvement Even in the Capitol itself the drainage system is incomplete and the drinking water arrangements are poor The unfavourable season from the hygienic standpoint is the winter when the marsh fever influenza small pox etc play havoc

In Seigipe as is the case in the whole of Brazil steps are being taken to improve conditions

The President draws attention to the high infant mortality due chiefly to the ignorance of the mothers

I. D

682 — **Notes on the Agricultural Conditions in the Italian Colonies** *Minister delle Colonie Ufficio Affari Economici e Industriali Informazioni Year X No 1 pp 116, plates 6* Rome Jan Feb 1

**TRIPOLITANIA** The Mediterranean has a remarkable influence on the coastal region which possesses a typical maritime climate in the area adjacent to the desert the forces which influence the maritime climate are in opposition with those of the desert climate and a certain modification results Inland it is quite hot and typically desert

Annual average rainfall to 4 mm The fauna is very varied livestock occupy an important position and tunny fishing and the sponge industry are given much attention and are remunerative

The flora is characterised by 1) The date palm and some 5400 plants young and fully developed to be found in the oasis on the coast of Tripoli 2) *Tagura Guita* and *Croguense* 3) the olive which is the sole fruit grown in the non irrigated area now under cultivation Several wild plants either aromatic or with oleaginous seeds or barks utilisable for tannins and dyes are also to be found

Agriculture is the chief industry and the small holder leads the way Cereals table grapes henna, which is largely exported to Algeria the central market for this crop, and olives grown in the coastal plains and in the Djebel are all recognised crops The progress made in olive cultivation the attention given to new plantations and the improved methods of oil extraction have all contributed to increased yield during recent years and the oil production will in future be estimated as sufficient for local consumption The extension of plantations and the further improvement of industrial methods should make it possible in the near future to have a reserve which may be utilised for export purposes

The decree issued by the Government on November 15 1911 provides land concessions under certain regulations Up till now taking into account the minor importance of such land which can be certified is available about 10 concessions have been made of limited area comprising 3000 hectares

Facilities of various kinds are agreed upon by the Colonial Government authorities

Tripoli is the tobacco factory centre and large plantations exist in the neighbourhood

**CYRENAICA** — Temperate climate which permits settlers to enjoy living conditions not unlike those of Southern Italy The average annual rainfall varies from 20 to 6 mm

As in Tripolitana, the fauna is distinctly varied. The livestock is, however, of finer quality, especially the sheep which possess superior wool. The sponge industry is most important, as regards both quantity and quality.

The flora is very rich, and includes all types characteristic of Italian plants especially on the upper plateaux. The plants most abundant are the broom, *Pistacia Lentiscus*, cypress, wild olive, carob and oak. The date palm, except in the oasis of Derna and the palm grove at Bengasi, is less luxuriant than in Tripolitana. The cultivated olive covers a very large area but is not so widely spread as the wild olive to which attention might be given.

Farming is the leading industry in Cyrenaica. The production of cereals is important, particularly barley. In 1919-1920, the yield was about 1 000 000 quintals, of which about 160 000 qx were imported into Italy, for food purposes and for malt, which has taken the place, to a certain extent, of malt previously imported from other countries. Some 150 000 qx were exported elsewhere.

Very few land concessions are granted by the Government in view of the small amount available for the purpose. On the other hand the farmers, either in groups or as Co-operative Societies are in conjunction with the native owners facing the problem of putting to useful purposes the large tracts of first rate cultivable land with easy access to the coast, which is now in possession of the native tribes.

The collaboration of the native tribes with the settlers indicates that the results will be satisfactory.

The facilities and premiums have been arranged and competitions organised in accordance with existing conditions by the Colonial Government with a view to agricultural development and stock raising.

In the north of Gasi el Mugtar on the Tripoli borderland in Butic extensive sulphur deposits are found which are easy to work although situated the surface. The sulphur obtained is usually transported to Bengasi and sold in the local markets. Considerable quantities are exported to Egypt, and employed in the tanning of 'gale' of camels.

**ERITREA** In the plain on the sea level the climate is tropical. In the Upper plateau, the climate resembles that found in temperate regions, with marked differences between the warm and the cooler hours of the day. In the intermediate area, between the plateau and the sea, wide variations in temperature are met with according to the seasons; the days may be subject to torrid heat and the nights are almost as cool as in the upper plateau. On the inland lower plateau the day temperature is equal to and sometimes higher than that on the coastal lower plateau, and the nights are comparatively cool. The lowest average annual rainfall is recorded at Assab viz 25.8 mm, the highest at Addi Ugri, 788.5 mm.

The fauna and flora are very rich and very varied. The doum palm, the broom and even aloes, *Sansevieria* sp. are remarkable for their abundance. Cattle and sheep are numerous, a large majority of the native population devote their attention to stock raising.

The most important industry of Eritrea from the economic standpoint is agriculture, and the flora has great possibilities, considering the geographic situation of this region, and the evident advantages of having both a temperate and a tropical climate. The river reservoirs of Mt Belesa, the irrigation barrages of Zula and Haut-Falcet, are intended to raise the value of land which when irrigated will render these almost arid regions available for valuable tropical crops.

A well-planned exploitation of wild and cultivated fibre plants (agave and *Sansevieria*), camphor, aloes and tan bark plants is being undertaken. Plantations of tobacco and coffee are beginning to give satisfactory results.

The yields from the doum palm which grows wild and vigorously in the Barca valley and its tributaries and in the valleys of the Gasc and the Setit, are exploited to a large extent. The nut from the fruit is utilised in the ivory button industry in conjunction with the American corozo. Agordat and Cheren are the chief trade centres for this article.

The first machinery installations for the stripping of the agave and dealing with the fibre have given excellent results.

There is considerable amount of State Land available especially in the Lower Plateau. Land concession is regulated by special provisions introduced by the Land Organisation approved by Royal decree on January 31 1901 No 376.

All concessions are subject to yearly dues which may be redeemed on certain conditions. Exemptions are allowed to farmers on special conditions.

There have been up till now 176 concessions referring to 17 350 hectares in all.

Sheep and cattle are numerous and constitute an important part in trade of this Colony. The much-valued skins represent alone one of the chief export articles. The preserved meat and slaughter house by-products are dealt with at Sembel (Asmara).

As regards hunting elephants are found in Cunamo and Licazze lions in Assaouta and in Barka. Megrich leopards and panthers hyenas and jackals everywhere hippopotami in Gasc and Setit alligators in several rivers and in the pools of torrents. Large numbers of apes of all kinds and species especially noticeable owing to the damage done to doum palm fruits and tamarisks antelopes wild boars and various types of birds. All these animals are of commercial value in connection with Zoological Gardens in other countries.

Indications of pho phoric and potassic salt formations have been noted in Damabris. **SOMATII AND** On the coastal region the monsoon winds tends to maintain an almost uniform climate throughout the year the daily temperature varies between 22 and 32°C but inland where the effect of the wind is less and the atmospheric humidity low the temperature varies from 15°C during the night to 35°C and even to 40°C during the day.

The average annual rainfall in the more favoured regions of Benadir does not exceed 350 mm. The factor which influences the vegetative development is not the temperature which is equally distributed during the seasons but the water supply dependent on the rains coming from Ubi Chebeli and Djouba and which represents the most valuable asset of the Colony.

The fauna and flora are uniform throughout the region except in the very fertile areas along the Djouba and to a certain extent on the banks of the Chebeli where the splendour of the tropical vegetation is a source of admiration during the whole year. The most common plants are the doum palm the baobab and resinous acacias.

Livestock is the most important industry and half the population almost exclusively composed of natives is thus occupied. The region best adapted to stock raising is in Benadir where the pasture land is luxuriant, and the stock generally allowed to remain in the wild state, except in the district round Ubi Chebeli, starting from Andegle, where only semi-wild. A census taken on February 1 1920, demonstrates that in Benadir only, were 2 101 176 camels 124 461 cattle 1 666 308 sheep.

Native agriculture is of poor quality, and the economic results are characterised essentially, except perhaps in the case of cotton by the production for local consumption rather than for export. The cultiva-

tion of dourah, typical of arid zones, of "uembe", of native cotton, of maize, of sesame of haricots, occupies a good half of the population grouped in villages, on the bank of the rivers Djouba and Chébeli, or in fairly scattered groups in Dafet, Baïdoa, and round Itala.

In Somaliland, the two great rivers should play a considerable part in the improvement of land values, permitting the introduction of tropical crops important from the industrial standpoint, especially cotton, sugar cane, tobacco, sesame and kapok; this however, naturally entails capital and European technical direction, with manual labour supplied by natives, accustomed to the climatic conditions. White men cannot do heavy, outdoor work owing to the climate and to obtain this manual labour without difficulty a successful step has been taken in securing the collaboration of the native element with Italian settlers. In this way, the "Società Agricola Italo-Somali" has found no difficulty in the carrying out of important barrage schemes and utilisation of the waters of Uebi Chébeli for the irrigation of newly exploited areas in the Sidle-Moyen, and plantations will shortly be laid out.

There is plenty of State land available. The concessions are regulated by special provision contained in the Colonial Land Organisation approved by royal decree on June 8, 1911, No. 520. The concession costs demand only the payment of a modest annual rent which may be redeemed. Exceptions are made for certain small holders, who are exempted from payment.

The concessions so far accorded, include just over 5000 hectares. Apart from this, there are numerous tracts of land, belonging to natives, which have already been developed by the Italian settlers.

Just as in Eritrea, the land is rich in wild beasts. Elephants, rhinoceros, buffaloes, are found near the two great rivers, especially the Djouba, also hippopotami, and a large number of crocodiles, numbers of lions and leopards are found in the Balli region, antelopes, gazelles, wild boars everywhere, all of commercial value for parks, circuses, zoological gardens, as well as for their skins.

Fish appear to be abundant and help to feed the coastal population, and after pickling in brine serve as a valuable export product, and afford by products.

G. A. B.

#### EXPERIMENTAL WORK

683 - **Importance of Technical Supervision on Sugar Plantations.** ROSENFELD, A. H., in *The International Sugar Journal*, Vol. XXIV, No. 270, pp. 140-143. London, March 1922.

With a view to securing better yields by ascertaining, under technical supervision, the maximum potential yield, fertilisers, irrigation and drainage requirements etc. of each acre, the Sugar Planters' Association in Honolulu has conducted a very interesting demonstration, and one pregnant with possibilities of super-intensive sugar production. The most outstanding result has been that for the last two years, the cane and long ratoons in this test have averaged 12 tons of sugar per acre, some areas yielding more than 15 tons per acre.

Assurance has been given that these results are neither accidental, nor are impracticable methods employed. These are enumerated as follows: 1) extraordinarily close technical supervision of each acre; 2) in-



tensive fertilisation, through ascertaining the *practical limit* and then applying required amount of fertiliser; 3) very careful irrigation, but no excessive quantities of water; 4) careful decision as to the proper time for cessation of irrigation and ripening the cane before harvesting. The last three on every sugar plantation are to a large extent contingent upon the first, a fact which hitherto has been too much overlooked. Apart from some of the most progressive countries such as Hawaii and Java, real technical supervision of sugar cane plantations has been almost unknown. The reported results in Honolulu should, however, demonstrate clearly the utility of technical care applied to production.

M. L. Y.

684 - The "Office Régional Agricole" in the South of France. — *Bulletin Trimestriel de l'Office régional agricole du Midi*, pp. 1-10. Marseilles, Jan 1922

AGRICULTURAL  
INSTITUTIONS

The agricultural bureaux consisting of a Department Office and an "Office régional" (District Office) were inaugurated on Jan. 6, 1919 (1) for the intensification of agricultural production.

The "Office régional" in the South of France covers the following area: Basse Provence (Bouches-du-Rhône, Var, Alpes-Maritimes); Lower valley of the Rhone, and of Durance (Drôme, Ardèche, Vaucluse and Basses-Alpes); the Southern vineyards (Gard, Hérault, Pyrénées-Orientales) and la Corse, which all together constitute the 8th district.

Headquarter- are established at Marseilles, temporarily at the Hôtel de la Préfecture (Direction des Services agricoles).

The directing committee consists of:— Inspector general of agriculture for the district concerned, two delegates from each of the departmental offices. The Directors of the Agricultural Service assist at the meetings for consultation purposes.

The agricultural offices are corporate bodies and have financial liability.

(1) The law of January 6, 1919 inaugurated the district agricultural offices and the department offices. The former represent each agricultural inspection centre. All possess a single organisation consisting of a council which is expected to meet at least twice each year; before December 15, propositions etc. are put before the Ministry of Agriculture, and further schemes are subject to the decision of the Ministry. Every year, the district office submits a written report concerning all work undertaken and also that carried out by the departmental offices. The Inspector General of Agriculture sees that the decisions made by the various Offices are carried out and surveys the work of the various experiment stations.

The council, in each department, consists of 5 members, 2 at the most occupy the position of "conseiller général", the others represent the principal agricultural groups. The reunion of the Council is held on the convocation of the Prefect. The Council revises its line of activity in accordance with the suggestions made by Agricultural associations. The programme is examined by the Office régional and definite arrangements are made only in conjunction with the ministerial decision. Every year, the Departmental Office presents a detailed report on the work and this is transmitted through the Office régional to the Ministry of Agriculture. Departmental inspection is made by the Director of Agricultural Services in conjunction with the decisions of the Departmental and district Offices.

They have the right to take the initiative as regards improvements in the departments or in the district.

**ACTIVITIES OF THE OFFICE RÉGIONAL AGRICOLE IN SOUTHERN FRANCE.** — The activities of the Office are concentrated on: 1) the co-ordination of the work of the departmental offices, 2) the organisation of district experimental stations, 3) the co-ordination of scientific research etc. in the interests of agricultural progress and the protection of crops in the district concerned

*Co-operation of different branches of work of the Departmental Land Offices.* — Definite steps are taken at the General Assemblies where each of the Departmental Committees present an account of the work undertaken and the schemes in view. The Office régional has up till now directed the Departmental offices along the following lines: organisation of seed testing establishments, distribution of seeds and plants of pure types and well selected, joint control of diseases and pests, inoculation of herds; institution of itinerant lectures (wheat, livestock); reimbursement of losses of animal breeders, participation at competitions and demonstrations with a view to implement improvement etc.

*District Experiment Stations* — The existing number of stations is not less than 30, and they absorb a considerable part of the credits of the Office régional. The work of this Office is therefore clearly differentiated from that of the Departmental Office which concentrates its attention on popularisation of information supplied by the Office régional the experimental work being carried out on a uniform plan though under different conditions. These Stations are concerned with crop production of especial interest in southern France, and with stock raising, particularly sheep and pigs. Their schemes of work are checked by the Office régional after submitting to Committees consisting of 2 members of the Departmental Office interested, the President of this Office, the Director of Agricultural Service, the President of the Agricultural Association, an expert eminently suited to study the question, and the General Inspector of Agriculture for the District.

*Crops.* — Olive-growing in 5 centres: Villeneuve-Loubet (Alpes Maritimes), Le Luc (Var), La Fare (Bouches-du-Rhône), Lédénon (Gard), Pilacanal, Piscialetto and Ajaccio (Corse). M. BONNET, chief of the olive-growing association at Marseilles is appointed as director of this work. The programme is the same everywhere, the study of the best pruning methods, the effect of ploughing and treatment of surface soil, control of collar rot, pests (olive fly etc.), propagation of interesting varieties, treatment of old trees, use of fertilisers, and should the occasion arise, the improvement of machinery etc. in the neighbouring oil mill. Nurseries have been started at Ajaccio, Antibes and Aix.

Fruit growing:— at Solliès-Pont and Fréjus (Var), St. Vallier, Albon and Leveyron (Drôme), Prades (Pyrénées-Orientales), Cabannes (Bouches-du-Rhône) and Ajaccio (Corse). Experiments are in progress to ascertain the variety best adapted to local cultivation, the best manure,

the treatment of both plant and animal pests. Attention is also given to packing, transport and utilisation of the products.

Vine growing:— A National Experiment Station has been established at Montpellier. Stations have also been set up at Saint Marcel d'Ardèche (Ardèche), Sallèles d'Aude, Lafond de Long, Carcassonne (Aude), Gineaux en Camargue, Berre (Bouches-du-Rhône), Roquebrune (Var), le Gard and Ajaccio. A further station will shortly be established at Perpignan (Pyrénées-Orientales). Tests are being made with various stocks for local varieties, grafting, direct production, manure, control of pests.

Market gardening and flower growing — at Avignon (Vaucluse) and Perpignan, and probably shortly at Hyères (Var). Experiments are being made on the best varieties, manures, new varieties, control of pests.

Flower growing is specialised at Antibes. It is intended to establish a centre for aromatic flowers such as lavender in the Basses-Alpes.

Potatoes: at Alboussière (Ardèche) and Volx (Basses-Alpes).

Cereals: — at Maninet near Valence where (Drôme), very interesting results have already been obtained. Experiments are also in progress at Aix (Bouches-du-Rhône), Cuxac-Cabardès, and St. Michel de Lanes (Aude).

*Livestock.* — Sheep: In order to maintain a pure race in Southern France, the Office grants a subsidy for stock upkeep in the special sheepfolds at St. André-en-Quint, for the Quint breed, and in La Bâtie Verdun (Drôme), for the Corse breed and at Ajaccio for the production of Roquefort Cheese. A centre for the Larzac breed is proposed in Hérault.

Pigs.— the Marseillaise breed is being improved at Aix-en-Provence.

Silkworms: At Oraison (Basse-Alpes), experiments are being made in the feeding of silkworms owing to the efforts of M. GRAMER.

The Office régional also undertakes research work of general interest and contributes to the popularisation of motor ploughs, etc., and has brought to the public notice a machine adapted to the oil industry, etc.

As regards propaganda, the Office régional has assisted in the publication of several pamphlets dealing with the district, and intends to organise agricultural conferences illustrated by cinematograph. A central information bureau will shortly be established in Marseilles which should be useful also to the Departmental Offices, etc.

In addition, it has been decided to publish a quarterly Review dealing with the more interesting work in hand, with a summary of the various branches of newly-started work in other districts. P. C.

685 — **The National Agricultural Conference in the United States.** — *Journal of Farm Economics*, Vol. IV, N. 1, p. 61-63. Lancaster, Pa., Jan., 1922.

The National Agricultural Conference, called at President HARDING's request by Secretary of Agriculture WALLACE during the week beginning January 23, served to focus attention of the country on the agricultural situation.

A total of 336 delegates were in attendance, comprising representa-

EXHIBITIONS,  
MEETINGS,  
CONFERENCES

tives of farm organisations, agricultural journals, State agricultural colleges and departments, the seed, fertilizer, machinery, and allied business interests, and agricultural interests generally throughout the country. The intention, as expressed by Secretary WALLACE, was to bring together a group thoroughly capable of passing on the many phases of problems affecting agricultural production and marketing.

The Conference was addressed upon opening by President HARDING.

The first two days were mainly devoted to addresses by agricultural leaders from many sections of the country, presenting the facts as to current conditions and outlining some of the most important needs and problems before the country.

Following this the Conference broke up into twelve committees. For three days committees met, reported, and their reports were debated by the main body.

While the Conference presented a clear-cut picture of the depression which has affected agriculture for the past year, its recommendations were not directed entirely to relief of an emergency as such. Perhaps its most significant work lay in presentation of fundamental economic relationships between agriculture and other elements in the country, and in attempts to formulate some constructive lines of policy with regard to the national welfare.

A considerable number of resolutions were presented in committee reports and passed. In general, however, the outstanding action of the Conference revolved about four main propositions, namely More adequate financing for agriculture ; insistence on cheaper transportation and distribution costs , development of cooperative organization and freedom from legislative restraints thereon , recognition and fair adjustment of the farmer's economic status relative to other groups.

Some of the chief resolutions passed included :—

Enactment of laws, state and national, authorising cooperative marketing

Amendment to warehouse act facilitating the financing of stored crops and better protection of such crops

Better enforcement of State cold-storage laws and the enactment of a Federal Law

Establishment of more Federal standards for farm products

Passage of laws prohibiting inter-state traffic and manufacture of filled milk

Legislation compelling truthful labeling of raw and manufactured products such as truth in fabric bill now pending

Investigation by the inter-state Commerce Commission of the advisability of extending preferential rates to agricultural products for the purpose of promoting foreign trade.

Extension of the provision of the Webb Pomerene Act which provides for combination of concerns for export trade in order to meet competition of consolidated purchasing of other countries

Tariff protection for agriculture equal to that extended to other industries, establishment of tariff board to administer a permanent flexible tariff law with an anti-dumping provision

Importation of potash free of tariff.

Increased support of the International Agricultural Institute at Rome and appointment of agricultural attachés to foreign embassies.

Improved and greatly extended market reports on crops and live stock and the taking of census every fifth year.

Congressional legislation to meet the need for agricultural credit running from six months to three years such as is provided in the recommendations of the Congressional Joint Agricultural Commission; if this form of credits be not made available, the War Finance Corporation should continue to function until such time as may seem necessary and proper.

Amendment of the Federal Reserve Act so as to give Federal Reserve Banks authority to buy and sell notes secured by warehouse receipts covering readily marketable, non-perishable, agricultural staples or live stock, of the kinds and maturity now eligible for rediscount.

Recognition of agriculture, merchandising and manufacturing in the selection of the Federal Reserve Board and directors of Federal Reserve Banks.

Increasing the individual borrowing limit from Federal Farm Loans from \$10 000 to \$25 000

Congressional amendment to the joint-stock land banks so the banks may issue bonds to amount of twenty times their capital.

Extension of the activities of the Federal Farm Loan System so it may include all the commodities which the farmer usually puts up as collateral

Reduction of freight rates immediately to rates effective August 25, 1922.

Federal aid in highway building and farm-to-market roads and continuation of this policy for a definite period, so States may plan adequate cooperation;

The acceptance of HENRY FORD's offer to lease dam at Muscle Shoals, Alabama, and manufacture fertiliser

Retaining all bureaux of Department of Agriculture in that department.

Establishment of a National Agricultural Advisory Council

Appointment of a National and Commission to classify land areas. Determination of a policy of reclamation which shall be coordinate with the need for agricultural land and further economic conditions.

Effective legislation for stopping devastation of forests and a national consciousness of forest problems.

Extension of research work and increase of area devoted to forests

Improvement of rural conditions and farm home life

More research and agricultural educational activities, particularly an enlargement of agencies for gathering and disseminating accurate statistics on production, marketing and economic phases of agriculture in general

G A B.

686 - **The Smithfield Club Show in London and its Lessons.** — I. *Live Stock Journal*, Vol. XCIV, No. 248, pp. 583-593. London, December 9, 1921. — II. VOITELLIER, CH. and GRAN, A., in *Revue de Zootechnie*, No. 4, pp. 299-321. Paris, January 1922.

I. — A comparison between the Cattle Show organised by the Smithfield Club in London, in December 1921, and the preceding shows held there during the last century reveals the great changes that have taken place in English stock-breeding in that period.

According to the reports of the earlier Shows, most of the cattle exhibited were from 10 to 12 years of age, for the breeders found that the animals after having been worked for several years, could be fattened quickly at grass and sold to the butcher at a profit. On the other hand, the cattle exhibited of late years, have been much younger, as it has become customary to slaughter animals between 15 months and 2 years

of age. This change has had no unfavourable effect on the size of the individual animals, or the weight of the quarters: indeed, the chief statistics dealing with these points (published in 1872 and 1908), demonstrate that in the 50 years previous to 1908, the number of butcher's beasts, reckoned by the head of horned cattle, rose 750 000 which represents an annual increase of 200 000 tons of meat.

This shows that it is economical to kill cattle between the ages of 15 months and 2 years. According to some experiments made in the United States shortly before the War, 15 months appears the best age limit, for a greater increase of live-weight with smaller consumption of food can be obtained before 15 months than at any other period of the animal's life.

II. — The Annual Show of fat cattle held in London by the Smithfield Club is justly regarded as one of the most important exhibitions of the results of British Stock-breeding. The authors therefore were anxious to visit the Show in person and study it exhaustively, more especially as some innovations have been made such as making new classes for animals of less than 15 months old. These classes are open to most breeds and to exhibits in the Carcass Division.

The authors examine successively the constitution of the Smithfield Club, its financial resources, the programme of the Annual Show, the organisation of the latter and finally, the lessons to be learned from the Show.

THE SMITHFIELD CLUB was started in 1798, and its statutes have been but slightly altered. At the present time, it boasts of nearly 1400 members of which 350 are Life Members, while the rest pay an annual subscription of one guinea. Its sphere is limited to stimulating competition in the rearing and fattening of animals for the butcher.

*The financial resources of the Club* — These are confined to members' bequests made and profits realised on previous Shows. These revenues only amount to some £500. The Club receives no grant from the Government to defray administrative or exhibition expenses.

The Smithfield Club, on the occasion of its annual Show, is paid by the Society owning the Agricultural Hall a fixed sum in lieu of the gate-money which belongs to the said Society, and in addition a given proportion often amounting to a considerable sum, when the takings exceed a certain figure. They reached £1883 in 1920. To these receipts must be added the entrance fees for cattle and the fees paid for reserved stands by manufacturers of agricultural machines, seedsmen, and merchants taking part in an Agricultural Show, these amount to about £4 000; also the proceeds of the sales of catalogues, which reached £140 in 1920. If the members' subscriptions are taken into account the total sum available for the 1920 Show was £7240.

The Club paid out of this sum all the organisation expenses, the fees of the attendants and judges (£520) and the prizes awarded to exhibitors (£3820). This year about £5100 was given in prizes. In 1920, the budget closed with a profit of £1680.

This proves that official Shows, if well organised and held on premises free of rent, should be no charge upon the State finances.

**THE GENERAL ORGANISATION OF THE SHOW.** — The Smithfield Club Show has been held since 1862 in the same place where it is held to-day, viz., the Agricultural Hall at Islington, a building equidistant from the Abattoirs and from the Smithfield Meat Market.

The animals are not placed in stalls but are fastened to a rail about 3 feet high, so that they can be examined with equal ease both before and behind. The cattle lie on a wooden floor, about 6 in. from the ground and wide enough to allow for plenty of litter behind the cattle; this arrangement has the advantage of preventing the litter being carried away by the feet of the visitors. The Show building remains clean and there is an absence of dust such as rises when the floor is sanded. The feeding troughs, although movable, are fastened to the lowest iron bar.

The sheep-pens, which are also made of iron hurdles, are relatively low; this allows of both sets of animals being seen from the front when the pens are arranged in double rows.

Cards nailed on to small boards are suspended from a rod fixed above the rows of animals at a height of about 10 ft. On the cards are written the class, breed, number, age, in years, months and days, and the live weight of the animals, together with the names of the breeder and exhibitor; to these are attached cards showing prizes gained by the animals. In this way, the Show serves an educational purpose.

The exhibition of dressed carcasses takes place in an adjoining hall. Cards similar to those described above give the net weight of the meat, the weight of the fat, offal, tail, and hide, in the case of cattle, and the weight of the meat, fat, pluck and fleece in that of sheep. The weight of the meat and pluck alone are given for swine.

The dressed poultry are placed on their backs upon a slab with their heads hanging down, so that only the breast and feet are visible, unlike the practice in France. The method of exhibition shows off the breast development better than any other.

**Programme** — This contains two large divisions, the Live Stock Competition and the Carcass Competition respectively. The animals shown alive the first day are slaughtered the second day; the dressed carcasses being exhibited on the third day.

In the live stock division, there are 13 subdivisions for pure-bred animals (to each breed are allotted 3 to 5 places) and 3 subdivisions for cross-bred animals, the total number of classes being 58. The class for young bulls below 15 months old is an innovation. The limit of 15 months, which was the subject of much argument, is still considerably discussed, and a proposal has been made to reduce it to 12 months. All the animals must be castrated before they are 9 months old. In the case of ten breeds, the cattle must be entered on their respective Herdbooks, or have in their pedigree four successive pure-bred males.

**Sheep.** — These animals are allotted 89 classes for 17 breeds and 6 for cross-breeds. As a rule, there was for each breed one class for

sheep born in 1921 and 1920 respectively. The animals must belong to a registered breed and have been castrated before the age of 5 months. The sheep are shown in lots of 3.

*Pigs.* — There are 27 open classes, 16 for 9 pure breeds, 2 for crosses, 3 for piglings weighing less than 45 kg., on for young pigs weighing less than 64 kg. and 5 for pigs of less than 9 months. The latter are exhibited singly, whereas the animals in the preceding classes are shown in lots of 2. The conditions of registration in the Herdbook are the same as those for cattle. The boars must be castrated before they are 3 months old.

In the Carcass Competition, there are 4 classes for cattle, 6 for sheep and 4 for pigs. The classes are as follows :

- bulls, or heifers, of less than 15 months ;
- bulls over 15 months and of less than 2 years ;
- bulls of over 2 years and of less than 3 years ;
- heifers of not over 3 years.

This classification is not advantageous for heifers less than 2 years of age, though they are most valuable animals from the cattle-breeding standpoint.

In the 6 classes of sheep a distinction is made between those born in 1921 and 1920. The competitions are for long-woolled breeds and short-woolled breeds or their crosses respectively.

There are 4 classes for pigs, which are classified under the following heads ; pigs with a live weight of less than 45 kg. ; pigs with a live weight below 90 kg. ; pigs less than 9 months of age and below 135 kg. in weight ; pigs weighing between 72 kg. and 109 kg. and producing the best bacon.

The authors draw attention to the fact that the Carcass Competition is not as important as the Live Stock Competition as the number of classes in the former is smaller and the prices offered are of less value.

Although the conditions requiring registration in the Herdbook or a pedigree certificate are great guarantees against fraud, other additional measures are taken to ensure that the age of the animals shall not be incorrectly given. The regulations empower the Veterinary Inspector and stewards to disqualify any animal whose dentition proves its age to be more than has been stated.

One of the most interesting secondary features of the Show is the exhibition of dressed poultry. They are divided into 24 classes for pure-bred birds and their crosses, thus affording an excellent opportunity of comparing the conformation of the different breeds. The fowls must be plucked, except for the head and neck, they must not be singed, or have their breast-bones broken. The prizes awarded in the poultry division alone amount to £132.

. THE SHOW AS A WHOLE. — *Size of the classes.* — The size of the various classes in each division is almost the same, therefore there is little difference in the value of the prizes offered. When some breeds are more represented than others, this depends upon 5 classes being open to them instead of 3, which, is the usual number.



The large number of sheep in the Carcass Competition is chiefly due to 6 classes being open to them instead of 4 as in the case of the pigs.

After having examined the entry lists of the cattle, sheep, and swine, the authors come to the conclusion that in this Show, as in all other annual exhibitions, the number of animals competing is proportionate to the number and value of the prizes offered and that if the public are to be attracted and satisfied there must be a large number of classes.

*Judging.* — There is no jury. Two judges are appointed to decide the merits of the animals of one or several classes. The names of the judges are published when the programme is issued.

The judges carry out their mission according to their own pre-arranged plan. Should they fail to agree, they may appoint an arbitrator, who is called upon when occasion arises and decides the question and then retires. There are only 4 such referees for the whole Show, one for each class of live animals and one for the Carcass division.

There are thus only 44 judges. The Championship prizes are, however, always awarded in each division by 2 special judges appointed beforehand. They begin their work when their colleagues have finished judging the various classes, but according to the regulation hitherto in force they may not choose any animal as a champion of the classes, or breeds, which has been beaten at the present, or preceding Smithfield Show. This year, however, as in 1907, all the cattle competing for the highest honour of the Show had been beaten on some point, so that this regulation had to be suspended.

This method of awarding the prizes in competitions open to all breeds is much better than the plan formerly adopted in Paris, when a jury was formed composed of delegates from the jury judging the classes. But it entails the organising Committee finding two experts who have no special fancy for any particular breed.

Judging is carried out in the same way in the Carcass Division. Here, little attention is paid to early maturing and yield, the judges marking for quality of meat, proportion of fat, and the best cuts.

*Comparison of breeds and classes* — When examined successively, the various classes of cattle are seen to have very similar characters. They seem all to have had a common origin, or to be nearly related. No doubt there is a large amount of Shorthorn blood in all the animals, or they have been selected to conform to a single ideal: body parallel-piped, short neck, chest projecting, rump line perfectly straight, upper and under lines parallel.

The cattle are rather slightly built, as compared with those of the best French breeds. This depends partly on the fact that none of the animals are over 3 years of age, but also upon the great predominance of cattle of average bulk. The live-weight at a certain age is not the only factor to be taken into consideration even in butcher's beasts, far less in exhibits at a Show.

If the live weights of the animals are compared according to the method adopted in England viz., reckoning the weight at birth as zero, it generally

happens that the younger the animals, the higher is the daily increase in live weight. If the class of bulls of less than 15 months is considered, it is seen that the differences in development are very small between one class and another.

The conclusion reached by the authors is that the Smithfield Club Show brings into prominence the relative reduction in bulk of the English breeds, but gives no means of judging of their earlier, or later, maturity. The only advantage they can discover in the reduction of bulk is the better conformation of the smaller animals. But from the butcher's point of view, heavy beasts entail lower general expenses for the same yield and an equal proportion of fat, they are also more profitable to the Cold Storage Industry, always assuming equal yields and the same amount of fat, than smaller animals. It has also been scientifically proved that the latter require more nutritive elements for their maintenance alone. The large improved French breeds can thus well stand comparison with the English breeds.

The authors say that these observations also hold good for the breeds of sheep and pigs, and their conclusions regarding these animals are the same as in the case of the cattle

The English appear to share the authors' opinion where sheep are concerned and award higher prizes to large, less well-formed breeds, such as Suffolks and Cheviots (provided they mature sufficiently early and are very hardy), than to Southdowns. As the pigs are classified according to age, the development of each breed is best shown by the differences in the weight of the animals

*Carcass competition* — After examining the different classes the authors found that the prizes were awarded to the finest finished animals, whether cattle, sheep, or swine. Very fat animals are not sought after as much as formerly, hence there is no object in producing more than half-fat animals for the butcher. In judging the exhibits at the Show, more marks were given for the number of first-class cuts and the net meat return, than for fatness.

As regards the sheep, since the age of none of the animals in the classes was stated, the observations were limited to their conformation and the quality of the mutton. Southdown and Southdown crosses produce the best shaped legs of mutton with little bone and well-distributed fat.

*Conclusions.* — Although open to criticism on many points, the Show taken as a whole is of the greatest practical utility. It serves the interests of the breeders of pure-blood stock by demonstrating the meat-producing qualities of these animals. The over-fat condition of some of the exhibits may even be justified from this point of view. What appears to be merely a hobby often proves to have more practical bearing than is at first apparent.

In the Carcass Competition, the Show possesses within itself a useful check to any tendency to run counter to the pre-established object, for the value of the dressed carcasses can be as exactly determined as that of the live animals.

The two divisions of the Show are complementary.

F. S.

## CROPS AND CULTIVATION

- 687 - **Correlation between the Temperature and the Dates of Flowering in New England, U. S. A.** — LYON, C. J. in *Torrey*, Vol. 22, No. 2, pp. 19-20. Lancaster, Pa, April 1922.

AGRICULTURAL  
METEOROLOGY

Results of a series of observations made on the relation existing between the date of flowering of a large number of plants, and the temperature in New England (U. S. A.). The flowering period lasts from March for early-flowering species, till the end of June in the case of late-flowering species.

During the five years, 1917-1921, a positive correlation was evident between the date of flowering and the temperatures from March to June. Early flowering was very noticeable when the temperature was very high (1921), and the contrary effect was evident when the temperature was below the average (1917).

FRANCIS DARWIN arrived at quite different conclusions which contradicted any possible correlation between temperature and date of flowering.

G. A.

- 688 - **Methods of Studying the Concentration and Composition of the Soil Solution.** — PARKER, F. W. (Agricultural Experiment Station, University of Wisconsin), in *Soil Science* Vol. XII, No. 3, pp. 209-232, bibliography of 27 works. Baltimore, M. D., Sept 1921 (1).

SOIL PHYSICS

A more exact knowledge of the soil solution is desirable for the study of many of the problems of soil fertility and plant nutrition. For this purpose several different methods have been used which may be classified into 3 groups: 1) water extraction method; 2) methods which aim at obtaining the true soil solution; 3) measurement of the solution directly from the soil. Several methods have been employed to obtain the true soil solution such as compression, centrifuging, suction and displacement. The last method consists of packing the moist soil in a cylinder provided with an outlet at the base, and coloured water, ethyl alcohol, or paraffin oil etc. may be used as displacing liquids. In certain cases a combination of the suction and pressure methods was employed with a view to accelerate displacement. Several suggestions have been made for direct determination of the soil solution, such as electrical conduction and freezing point methods.

All these methods have their disadvantages. The water extraction alters the equilibrium in the soil; it undoubtedly has a solvent effect; the results vary with the ratio of soil to water, the time of extraction, the effect of the carbon dioxide content of the water, as show by MIRSCHERLICH.

The pressure method (applying a maximum pressure of 53 000 lb. per sq. in.) is only applicable to finer-textured soils, with a high moisture content and is liable to alter the physico-chemical equilibrium in the

(1) See *R* Feb. 1919, No. 154; April 1920, No. 338. (Ed.)

soil (NORTHRUP). This method requires a complicated apparatus. Even the centrifuge and suction methods are only applicable to soils with high moisture content and only small amounts of the solution are obtained.

As regards electric conduction etc. the results are affected by texture of soil and physical characters.

The ISCHEREKOV displacement method appears to be the most satisfactory and the author has selected this method for comparison purposes.

Glass percolators 2.75 in in diameter and 15 in depth were used ; the bottom filled with a one-hole stopper. A small quantity of coarse quartz sand was placed in the percolator and soil then added. After packing, the displacing liquid was added and maintained at a depth of 2-3 in.

The extracts were made by adding distilled water and stirring in a large mortar for 3 minutes. After leaving 12 minutes, the mixture was filtered through Pasteur-Chamberland filters.

Freezing point determinations were made in the usual manner with a BECKMANN thermometer, and served as a means of determining the direct soil solution and also the concentration of the displaced solution and of the water extract.

Nitrates were determined colorimetrically, calcium, volumetrically, and organic matter by weight.

Ethyl alcohol, methyl alcohol, acetone and water were used by the author as displacement liquids. Ethyl alcohol gave the most satisfactory results and is very easy to test for its appearance in the displaced solution by means of iodoform reaction. The alcohol content in the filtrate possessed a very high concentration owing to the solvent action.

The composition of the soil solution obtained by displacement was not influenced by the displacing liquid used, the change therefore is not affected by the time of extraction.

The concentration of the displaced solution, all things being equal, was found to be inversely proportional to the moisture content of the soil. This agrees with the ISCHEREKOV observations. A comparison between the displacement method and water extraction shows almost identical results, the ratio between water employed and soil being 5 : 1.

As regards the freezing-point method, the results were very different from those obtained by calculation.

The depression of the freezing point has generally been greater than that of the displaced liquid. After numerous and varied experiments, the author concludes that the finely divided material causes this depression, probably due to capillary condition. A similar effect is produced with benzene and nitro-benzene.

Soils and well washed material freed from adherent moisture by centrifuging showed marked and nearly equivalent depressions of freezing point. This indicates that the moisture film adhering to solid particles in suspension opposes to a certain extent resistance to freezing. Depression of the freezing point is to a marked degree independent of

the dissolved material but the hypothesis of BOUYOUKOS and Mc COOR (1) which assumes that a portion of the water in the soils is inactive and does not take part in the dissolving of salts in the soil should not be upheld as the displacement method indicates that all the water in the soil acts as a solvent. Soils with a high moisture content but where the capillary condition is limited, gave results coinciding with those obtained by displacement such results being of practical importance. The author strongly recommends the displacement method which is the least involved and the most exact and which hitherto has been too much neglected. I, V

689 - **Use of Various Culture Media in characterising Actinomycetes.** - CONN H S in *New York Agricultural Experiment Station Geneva N Y Chemical Bulletin* No 83 pp 1-6 Tables (Geneva N Y April 1911)

The actinomycetes form one of the most numerous and interesting groups of soil micro-organisms their colonies may comprise from 40 to 50 % of all the colonies developed on the Petri plates (CONN)

A large number of types occur in the soil and a study of the morphology and chromogenesis permits direct classification

For some time they were grown on ordinary media sometimes on the glycerin agar media. KRAINSKY seems to have been the first to call attention to the fact that media containing no protein are much better adapted to bring out the characteristics of the different species. Chromogenesis is more frequent and more typical and may be of three shades depending on whether the colour is formed before aerial hyphae are produced or in the mycelium or in the media. The animal parasites do not appear to adapt themselves as readily as the saprophytic group to the simple media (without protein)

About 75 cultures were selected from 300 cultures obtained from various different soils. The formula which proved the most satisfactory for continued study was agar-agar 15 gm glycerin 10 cc dibasic potassium phosphate 1 gm sodium asparaginate 1 gm water 1000 cc. This very simple formula gives characteristic and vigorous growth. Cultures which are not distinguishable in this media may be separated in a malic acid or citrate media with glycerin, or in a medium adapted according to CZAPK's formula modified by WAKSMAN

The use of pure chemicals is advised and in exact measurement of the quantities of media employed as the slightest error may have a marked influence on the results. A further study of the media is recommended

I, V

690 - **Depth for Sowing Grass and Clover Seed.** WILLIAMS R D (Plant Breeding Station, Aberystwyth), in *The Journal of the Ministry of Agriculture* Vol XXIX No 1, pp 53-60 and No 2 table 1 pp 13-137 London, April May 1922.

Various opinions are held as to the most advantageous depth for sowing grass and clover seeds. To establish some definite basis on which to work

METHODS  
OF  
CULTIVATION

(1) See R 1921 No 597 (Fd)

experiments were made recently in England with the following species (1): CLOVERS: 1) Red (*Trifolium pratense*), 2) White (*T. repens*). — GRASSES: 1) Perennial Rye Grass (*Lolium perenne*); 2) Cockstoot (*Dactylis glomerata*); 3) Meadow Foxtail (*Alopecurus pratensis*); 4) Rough Stalked Meadow Grass (*Poa trivialis*)

Seeds were sown at varying depths in pots, boxes and beds in a light loam, and the selected seeds were tested for germination before sowing.

RED CLOVER. — A comparison of results given, at different depths proved very conclusively that the seeds should never be left uncovered, not only owing to the fact that uncovered radicles of seedlings take a hold on the soil with difficulty, but also because the marked effect on percentage of germination e.g. Pot cultures sown on the surface gave a 52 % germination (14 days after sowing) compared with 88 % at  $\frac{1}{8}$  inch. depth sowings

The best depth at which to sow red clover seeds in light loams appears to be  $\frac{1}{2}$  to  $\frac{3}{4}$  inch. Deeper sowings appear to have a deleterious effect on stem formation during the early stages of plant development. e.g. the average number of stems per plant at about 8 months after sowing, gave 2.2 for surface, 3.0 for  $\frac{1}{8}$  inch depth, 2.6 for 1 inch, and 2.4 for 2 inches. Apparently also, the seedlings are unable to reach the surface when sown too deeply this was proved by experiment, when the percentage of surface seedlings from seeds sown at a depth of more than 1 inch was nil

WHITE CLOVER. — Similar results were obtained when surface sown except that in wet weather, comparatively satisfactory results were forthcoming on saturated soil. The best results, however, under normal conditions were obtained by covering the seeds to a depth of  $\frac{1}{4}$  to  $\frac{1}{2}$  inch. If covered to depths of over 1 inch, only a very small percentage of seedlings appeared to reach the surface, and when they did appear, the seedlings were very slender, and remained etiolated for some time.

Although the seedlings possess smaller cotyledon leaves than red clover and can therefore push their way more easily to the surface, this advantage is counterbalanced by the smaller amount of reserve food material at their disposal which doubtless explains their retardation and marked weakness

PERENNIAL RYE GRASS. — It was proved that seeds should not be surface sown except during a long, unbroken spell of wet weather. The best results both as regards the number of surface seedlings and yields were obtained when the seeds were covered at depths varying from  $\frac{1}{8}$  inch. to 1 inch. In a normal year, it would probably be safer, however, to cover to a depth of  $\frac{1}{2}$  to 1 inch. At depths of 2 in. and 1 in. about  $\frac{1}{3}$  and  $\frac{6}{7}$  respectively of the seedlings failed to reach the surface and the subsequent yields of 21 oz. and 4 oz. of green fodder obtained compared very unfavourably with the 50 oz. given by the 1 inch beds. The deep sowings had also a weakening effect on the seedlings which did eventually reach the surface.

(1) The Latin names have been inserted by the Bureau. (Ed.)

**COCKSFOOT.** — Surface sowing were also disappointing. For field sowing the best depth appears to be about  $\frac{3}{4}$  to  $\frac{1}{2}$  in. A greater depth has proved inadvisable; the number of surface seedlings showed a steady decrease at deeper sowings, e. g. 50 % at 1 inch depth, 16 % at 2 inches compared with 60 % at  $\frac{1}{3}$  inch. This is worthy of special note as cocksfoot is often included with seeds subjected to deeper sowing, and should be started under the most favourable conditions when placed in competition with quicker growing grasses such as the rye grasses. A very deep covering evidently has a detrimental effect on the tillering capacity of the young plant.

**MEADOW FOXTAIL.** — The best time for sowing appears to be either June or July. An interesting comparison of the germinating capacities of meadow foxtail and perennial rye grass in spring and also in summer is made. Apparently the rye grass seeds will germinate equally well during both seasons, but the foxtail will not germinate satisfactorily except during warm weather. That the best results are obtained when the seeds are sown in June or July was confirmed by an experiment in which the seeds were sown weekly from early May to August.

Satisfactory results were obtained from surface sowings in wet weather, but as the seeds are exceptionally light in weight, it is advisable always to cover, so that they may not be blown away. Although the experiments on meadow foxtail are not conclusive, it is considered that the seeds covered to depths of  $\frac{1}{2}$  to  $\frac{3}{4}$  inch will give good results, but that deeper sowings to a depth of 2 to 3 in. will result in complete failure.

**ROUGH STALKED MEADOW GRASS.** — The results indicate that the seeds should either be left uncovered or buried very slightly, especially during wet weather; when the germination was interrupted by a spell of fine weather, the seeds gave better results when very lightly covered eg., about  $\frac{1}{8}$  in. to  $\frac{1}{4}$  in.. The June and July sowings gave superior yields to the May and August sowings. The germination of the surface sown seeds is often delayed for as much as 6 weeks or more, even under normal conditions as regards moisture, but apparently shade and excessive moisture are conducive to good germination results. For instance surface sown pot cultures gave a 61-63 % of surface seedlings under shaded and excessive watering conditions respectively compared with 49 % when exposed to light and 57 % with normal watering.

In order to test the evidence given by the experiments here discussed, field trials designed largely to ascertain the depth of sowing under various operations, and to test the degree of excellence of the stands, were also conducted in 1920-21 and results are shortly to be published

M. L. Y.

691 - **Studies on the Decomposition of some Common Green-Manuring Plants at different Stages of Growth in the Black Cotton Soil of the Central Provinces, India.** — BAL, D. V., in *Agricultural Journal of India*, Vol. XVII, Pt. II, pp. 133-154, tables 8. Calcutta, March 1922.

Owing to the fact that black cotton soil, found throughout a large part of the Deccan (India), is so deficient in nitrogen and organic matter that

MANURES  
AND  
MANURING

green manures are essential, a detailed study has been made of the following factors connected with their application, viz 1) the rate of growth of plants used as green manures, 2) the composition of the plants at various stages of growth, 3) the rate of decomposition of the nitrogenous and carbonaceous constituents of plants at various stages and of different parts of plants i.e. leaves and stems 4) the effect of varying proportions of stems on the decomposition of leaves

Experiments were made with seeds of sann-hemp (*rotolaria juncea*) and dhaincha (*Sesania aculeata*) sown at the beginning of the monsoon. The soil used for both laboratory and pot culture experiments was from the Nagpur farm (1) a typical black cotton soil

From the results obtained it is evident that as the green plants advance in age, the proportion of leaf to stem decreases also the percentages of moisture but the percentages of carbon carbohydrates and fibre increase. There was no appreciable change in the nitrogen percentage.

The following Table shows the results of a detailed analysis of the various samples

*Composition of Green Manure Plants at various Stages of Growth*

Green Manure	Moisture	Ether extract	Protein	Fibre	Ash and sand	Carbohydrate	Nitrogen	Carbon	Organic matter
Sann hemp (1 week growth)	88.5	0.16	2.74	1.81	1.60	5.10	0.44	5.11	9.90
" " (4 weeks " )	82.5	0.27	2.79	5.69	1.80	6.95	0.45	7.84	15.70
" " (8 weeks " )	74.6	0.68	1.99	10.55	2.62	9.66	0.32	11.15	22.88
" " (12 weeks " )	65.0	0.47	2.01	16.56	1.90	14.06	0.32	15.86	33.10
" { " " { " { stem alone }	64.0	0.38	1.44	19.30	1.33	13.55	0.23	16.13	34.67
" { 2 weeks { " { leaves alone }	69.0	0.90	4.42	6.41	2.90	16.37	0.71	13.46	28.10
Dhaincha (1 weeks growth)	89.4	0.19	3.15	0.92	1.57	4.77	0.50	4.48	9.03
" (4 weeks " )	82.6	0.47	3.18	4.68	1.62	7.16	0.51	7.95	15.78
" (8 weeks " )	79.0	0.72	3.13	4.69	2.24	10.22	0.50	9.35	18.76

The earlier the sann hemp is used as green manure the more rapid is the decomposition of its carbonaceous and nitrogenous constituents. This is evident from the data given as regards the total percentage of nitrogen nitrified at various stages of maturity in leaves and stems. The diminution of nitrifiable nitrogen in sann-hemp of advanced age does not appear to be due to any deleterious influence of the stems upon the nitrifi-

(1) Physical analysis, clay 45.62 %, fine silt 21.82 %, silt 10.79 %, fine sand 4.23 %, coarse sand 6.04 %, moisture 6.37 %, calcium carbonate 0.10 % (See B. DALY in The Biological Determination of the Relative Availability of Different Nitrogenous Organic Manures in Black Cotton Soil, *Agricultural Journal of India, Special India Science Congress No 1919, Vol XIV, Pt III*)



cation of leaf nitrogen. As a result of the chemical determinations made in connection with the fibre resistance to the action of micro-organisms it is possible to attribute the reduction in nitrification with advanced age to the increasing amounts of fibre and the consequent comparatively non-available form of the nitrogen content. The increasing amount of carbohydrates, however, very probably exerts some deleterious influence on nitrification, but no definite opinion is given as regards this point. The regular decrease in moisture content with advancing age of the green manure is, however, considered to be partly responsible for the decrease in nitrification.

The nitrogen in the leaves of the sann-hemp is apparently more easily nitrified than that in the stems. During the experiments made, the decomposition of the leaves of mature sann hemp, covering a period of nearly 3 weeks, produced twice as much carbon dioxide as that of the stems. This indicates that when the plant is 12 weeks old, the leaf carbon is more readily oxidised than the carbon in the stems. The slowness of decomposition in fully matured green plants should not be attributed to any effect of the increasing proportion of stems in relation to leaves, but rather to the change in the physical condition of the plant tissues etc. The fact that the presence of stems does not affect oxidation of leaf carbon is indicated as follows —

- 5 gm leaves alone per 100 gm soil gave off 153.1 mg of carbon as carbon dioxide,
- 5 gm stems alone per 100 gm soil gave off 128 mg of carbon as carbon dioxide

With *Sesbania aculeata*, there was no marked decrease in the rate of nitrification of the comparatively older plants, though there was a certain amount of decrease in the decomposition of carbonaceous constituents.

While these results throw some light on the quantitative rate of decomposition of the nitrogenous and carbonaceous constituents of green manuring plants, they also confirm the results obtained in experiments showing that sann hemp of about 6 weeks growth is in a condition to undergo rapid decomposition and so becomes of value to the succeeding crop; the moisture factor should, however, not be overlooked. M. L. Y

692 — **The Effect of Straw on the Biological Soil Processes.** — MURRAY, T. G. in *Soil Science*, Vol. XII, No. 3, pp. 233-259, fig. 1, bibliography of 14 works. New Brunswick, N. J., Sept. 1921.

In the wheat-growing areas to the east of Washington the return of straw to the land constitutes the only practical method of restoring organic matter to the soil, but it is known that this reduces the yield of the succeeding crop.

It was considered advisable to ascertain the reason for this reduction in crop yield, and if possible to devise a method by means of which the straw could be utilised without this drawback.

The matter had already received attention, STÖRMER showed that the addition of carbon bisulphide to a soil treated with straw doubled the yield. VAN SSELHORST and FRECKMANN found that when nitrates

were applied, denitrification was proportional to the amount of straw present, and that lime and sulphuric acid lessened, but did not overcome the effect of the straw on the crop yield. CHIRIKOV and SCHMUK state that on sandy soils calcium carbonate acts in the same manner, and that the injurious effect of the straw is not due actually to denitrification, but to the conversion of nitrates into insoluble nitrogen compounds. BISCHOFF grew mustard and buckwheat and found that on sandy soil the injurious effect of straw was more marked than in the case of clay soils and that nitrate of soda reduced the loss. VON MAY studied the effect of straw on potatoes and suggests that the loss is caused by the fact that microorganisms appropriate the available nitrogen as a source of energy. DORYLAND in the case of oats, found that the addition of straw in large quantities to the soil caused a decrease in the ammonifying power and an increase in the consumption of ammonia and nitrates. These results were due to an increase of microorganisms, favoured by the addition of straw, the same effect being produced by the addition of dextrose to soil.

The author placed soil in glass tumblers containing about 130 gms. and added finely chopped straw in amounts of from 0.1 gm. to 5 % and 0.2 gm. of ammonium sulphate.

The tumblers were kept at a temperature of 20° C. And the work was carried out in duplicate, with controls. Determinations of nitrate content and total nitrogen were made every six weeks.

After 18 weeks, there was a loss in every case in nitrate formation, and a reduction of the original nitrate content, proportional to the addition of straw. When more than 0.9 % straw is present a harmful effect is exerted upon the process of ammonification. At the same time, the total nitrogen remained constant, the nitrates being transformed into organic substances not available to plants. The bacteria increased in numbers, and evidently utilised the nitrates and changed them into more complex forms. The straw also served the bacteria as a source of carbon and the nitrates as a source of nitrogen. The organisms found to multiply in this manner are those usually present in the soil, such as *B. subtilis* and *B. mezatherium*.

Many others were found when straw was present, e. g. *B. siccus*, *B. lactis*, *M. radiatus*, but those normally found in soil predominated. The colonies had a softening effect on agar-agar, probably due to the setting free of nitric acid.

The author isolated a species of nitrifying bacterium capable of liquifying agar-agar in a few weeks.

L. V.

693 - **The Influence of Wheat Straw on the Accumulation of Nitrates in the Soil.** — SCOTT, H., in *Journal of the American Society of Agronomy*, Vol 13, Nos 6-7, pp 233-258, figs 7, bibliography of 28 works. Lancaster, Pa and Washington, D. C., Oct 15, 1921

The application of straw to cropped land and its apparently injurious effects, indicates lack of nitrogen and led the author to undertake a study of the effect of straw on the accumulation of nitrates in the soil.

The general problem of organic matter and nitrification has occupied the attention of a large number of investigators. The author reviews the literature this subject. WINOGRADSKY and OMELIANSKY showed that glucose and the peptones retarded the activity of the nitrifying organisms at concentrations exceeding 0.025 %; their work being completely arrested by the presence of 0.2 % of these substances.

Small quantities of organic matter did not seem, however, to hinder nitrification. As regards the straw, results are contradictory and depend on the amount applied, the type of soil, the quality of the straw, etc. This accounts for the fact that HILL noted a favourable effect, WRIGHT found that the process of nitrification was inhibited until decomposition was well advanced, and NIKLEWSKY demonstrated that straw has an appreciable effect on the action of sulphate of ammonia and nitrate of soda.

The author carried out an experiment under glass and in the field. Nitrate determinations were obtained by the phenoldisulphuric acid colorimetric method of analysis and parallel determinations were made from time to time using the aluminium reduction method.

In the experiments under glass, straw was applied at the rate of 0.5 and 1 %. In both cases the nitrates disappeared almost entirely at the end of 15 days. At the end of 36 weeks, the soil with 0.5 % straw slightly exceeded the control. If sulphate of ammonia is applied to the straw (0.1 and 0.5 %) for 2 weeks, there is a marked decrease in nitrates, but this is followed by a rapid increase up to a maximum of 2.1 ‰ of nitrates compared with 0.35 for the control, and 0.31 in the soil to which straw alone had been applied.

In the field several plots of equal size were treated in various ways. The soil is a silt loam and straw applied at the rate of 2 and 4 tons per acre had a distinctly injurious effect on the growth of wheat, hindered ripening and reduced the yield except on plots possessing a high nitrate content at the time when the straw was applied.

In one case, the yield was higher than that of the control. Otherwise, when 4 tons of straw per acre were applied and worked into the surface 6 inches, the nitrate content was low in the spring, but during the summer the equilibrium was re-established. At the rate of 2 tons per acre, no effect was observed. Four tons of straw applied as a top dressing reduced the nitrate content the following spring and summer; 2 tons had no effect in the spring but a fairly marked increase of nitrates in the summer. Straw application showed the lowest temperature and the highest moisture content, especially as a top dressing. L. V.

694 - **Experiments on the Season for the Application of Sodium Nitrate and on the behaviour of Leguminous Crops after the Application of Nitrogenous Manure.** — AVANZI, E. (Istituto Agrario della R. Università di Pisa) in *L'Agricoltura Italiana*, Year XLV, Pts. 2-3, pp 1-10. Pisa, 1922

Report of field experiments made on small plots or in frames in the autumn, 1918 to 1921. The crops concerned were: winter wheat, wheat, sugar beet, maize, fodder beet, spring wheat, maize, hemp, spring flax,

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millet, sarrasin, haricots, clover, sainfoin, lucerne, beans, lupin, green peas and vetch. In some cases a single application of sodium nitrate was made and in others several applications control plots being kept for comparison, and finally, with others nitrogenous fertilisers were employed. Attention was paid to unusual weather conditions, and in certain cases, an analysis was made of the soil, especially with reference to the nitrogen content. After determinations were made as to the nitrogen percentage of certain crops (leguminous), the ratio was estimated, and when raised to 100 used as the basic index for the control.

From the results taken as a whole, certain conclusions may be drawn, taking into account the conditions under which the experiments were made. With the winter wheat on clay soils, which are poor in nitrogen, it appears that the application of sodium nitrate may be held back with advantage until the time arrives for tillering, which in the area concerned, starts towards the end of the winter. With the spring wheat, no definite conclusions are possible, as no opportunity was allowed for recording the grain weight. It appears, however, from a survey of the yields in general, that the results obtained in the foregoing experiments are justified, as the best results were given when the sodium nitrate was applied at the sowing period and later at the tillering stage.

With maize, the following result was obtained: the yield increased as the application of the sodium nitrate was retarded. It should be noted that the soil concerned was fresh, somewhat light and quite fertile. With forage maize, cultivated in light clay soil and sown early, contrary results were obtained and early applications of the nitrate gave the best results; the highest yield was returned when the nitrate was applied at sowing time.

With forage beet grown on clay soil, the yield was highest, when two applications were made, once at sowing and once as a surface dressing. The yield obtained in this way, although much greater than that obtained when one application only was made at sowing, is far inferior to that obtained when the whole quantity was applied as a surface dressing.

With hemp, results do not agree; but it seems to be advantageous to apply the nitrate twice, as surface dressings. With flax, on the contrary, an opposite effect is shewn.

With leguminous forage crops, it has been proved that the most practical method is to apply in moderate quantities after sowing. Used in larger amounts, the yield tends to decrease, with the exception of clover and sainfoin, but as a general rule, an increase in nitrogen content in the roots and stocks was found. Medium quantities of nitrate have proved useful for all other leguminous crops.

Results indicate that the beneficial effect of sodium nitrate does not apply only to the first crop, but also to the following crop.

There is no tendency to modify the popular opinion with reference to sodium nitrate as a manure, but results taken as a whole indicate, however, that for clay soils, where nitrification is slow and inactive, and

where the loss of nitrogen is less to be feared, the application of sodium nitrate may be hastened opportunely. Even in districts, where spring rains are scarce, the application of this fertiliser may be hastened to advantage, on condition, however, that only relatively small quantities of fertiliser are used, in order to prevent any possible deleterious action caused by drought. It should be noted in such cases that, if an early application of nitrate is likely to result in partial loss, delay may impede its complete utilisation.

The question which concerns the existing relation between green manures (leguminous) and the nitric nitrogen and fixation of atmospheric nitrogen by these plants, is not dealt with to any considerable extent.

These experiments are still in progress both in the field and in the laboratory.

G. A. B.

695 - **The Influence of varying Amounts of Sulphur in the Soil.** — LIPMAN, J. G., PRINCE, A. I., and BLAIR, A. W., New Jersey Agricultural Experiment Station, *Soil Science*, Vol. XII, No. 3, pp. 197-207, figs. 2, bibliography of 15 works, New Brunswick, N. J., Sept. 1921 (1)

The senior author has already called attention to the rapid oxidation of sulphur when intimately mixed with the soil, and with McLEAN and LINT has shown that the phosphoric acid of rock phosphate is made available by the sulphuric acid thus formed. Sulphur was also suggested as a means of combating potato scab. It was recognised that the sulphur might have a detrimental effect on soil reactions, nitrate formation and crop yields. In order to obtain more definite information as to the action of sulphur, experiments were carried out in which sulphur was added at the following rates per acre: 200 lb., 500 lb., 1000 lb., 2000 lb., 4000 lb. Each plot had a control to which no sulphur was added. All plots received fertilisers containing 4 % nitrogen, 10 % phosphoric acid and 3 % potash, at the rate of 600 lb. per acre. This was made from dried blood, acid phosphate and chloride of potash. Barley and soya-beans were grown in succession. The sulphur and fertiliser were broadcasted a few days before sowing the barley. Immediately after the harvest, at the end of July, the ground was disked and sown with soya-beans, harvested the 3rd October. Germination was fairly uniform, but as the season advanced there were signs that injury was being caused by the heavier applications of sulphur. The greatest yield was given by the plot to which was added sulphur at the rate of 200 lb. per acre: if this quantity was exceeded there was a decline in yield, until with 4000 lb. of sulphur almost all the plants were killed.

The beans were harvested on October 8: the yield was greater on the plots given 500 lb. than those with 200 lb. of sulphur; this may have been due to uneven distribution of seed. The larger applications of sulphur reduced the yield to such an extent that where the greatest amounts were applied the plots yielded nothing but grass and weeds. The control plots

(1) See. R 1919, No. 193; 1920, No. 397; 1921, No. 25 and 804. (Ed.)

always gave a higher yield than those with sulphur. The detrimental influence caused by the larger additions of sulphur is due to the formation of sulphuric acid. The increase of acidity was shown by determination of the hydrogen-ion concentration, carried out every two weeks by the colorimetric method of GILLESPIE. In the case of plots receiving the heaviest applications of sulphur the pH values varied from 5.6 at the outset to 3.9 — 3.6 at the end of the tenth week.

The plots to which the lowest additions of sulphur were made gave acidity readings quite close to those of the check plots. The results obtained are set out in two very convincing tables. The lime-requirement determinations were carried out by the modified VEITCH method, and showed that a knowledge of the pH values will, in many cases, enable a forecast to be made as to the lime-requirements of a soil.

In the nitrate-determinations the colorimetric method described by SCHREINER and FAHMYER was employed. Attention may be drawn to the low nitrate concentration of the sulphur-treated plots immediately after harvesting the barley. Nitrates were found in considerable quantities in samples from plots that showed the highest hydrogen-ion concentration.

This seems to indicate that nitrification is not necessarily inhibited by a highly acid condition of the soil; a view which, although confirmed by other workers, is contrary to that hitherto held by most investigators.

L. V

696 — **Nitro-Cultures and their Distribution in Canada.** — INGLIS, R. A., (Junior Botanist Central Experimental Farm, Ottawa), in *The Agricultural Gazette of Canada*, Vol IX, No 1, pp. 14-17, fig 1 Ottawa, Jan Feb 1922

In 1915, the Central Experimental Farm in Ottawa undertook the free distribution of nitro-cultures throughout the Dominion of Canada. This Service is too little known and appreciated. The author considers it advisable, therefore, to give a short account of its objects, work and methods.

Amongst the large number of bacteria which exist in the soil, only two or three species are concerned with the problem under discussion. The Leguminosae is an extremely large family, but amongst the crops grown in Canada, which include rather more than a dozen species, all the plants live symbiotically with the organism known as *Bacillus radicicola*, with the exception of soy bean.

This bacillus has, however, developed specific strains, adapted to the inoculation of certain leguminous crops and as a general rule cross-inoculations between these groups do not occur or, if they do, it is only with difficulty. Generally the best results are obtained with organisms belonging to a specific plant on other plants of the same species. The bacteriologist's work does not therefore end with the isolation of the bacillus, but demands classification of the various strains. It is recognised that four groups of bacteria appropriate to 4 groups of leguminous plants are sufficient for the farmer.

I. CLOVER GROUP: including *Trifolium pratense*, *T. incarnatum*, *T. repens*, *T. medium*, *T. hybridum*;

II. ALFALFA GROUP: including *Medicago sativa*, *M. lupulina*, *Melilotus alba*, *M. officinalis*;

III. PEA GROUP: including *Pisum sativum* and var. *arvense*, *Vicia sativa*, *Lathyrus ocastratus*;

IV. BEAN GROUP: includes *Phaseolus vulgaris*, and *P. multiflorus*.

The soy bean *Glycine hispida* is inoculated by a different organism, probably a *Pseudomonas* (LÖRNIS and HANSEN, Jan. 1921), still under observation.

The finished product as it comes into the farmer's hands consists of a corked phial containing a jelly substance, viz. the artificial soil medium with the nutritive substances in solution requisite to maintain the bacteria alive in transit, and a thin layer of viscid transparent slime, which consists of millions of bacteria. Each bottle contains on an average, sufficient bacteria to inoculate about 1 bus. of seed of the particular variety specified by the farmer. These bottles should not be exposed to direct sunlight, which would kill the bacteria, and should not be opened till required for use.

The transference of the bacteria to the seed is effected by washing the slime of the jelly by means of some liquid; sweet skim milk with a little sugar added has proved satisfactory. The seeds are treated with this slightly sticky liquid and are sown when dry. A cloudy day is best for sowing, to avoid exposing the bacteria to sunlight.

The Dominion and provincial agricultural institutions are supplied at their request, with reasonable quantities of culture, within the resources of the central station. Individual farmers are not allowed gratuitously more than 3 bottles each, sufficient for treating some 180 to 200 lb. of seed. Each applicant should state the kind of seed he wishes to inoculate and an approximate idea of the date of sowing, to enable the Station to supply the cultures as fresh as possible. Applicants are requested to co-operate with the Station by sending information as to the results of inoculation. Two reports are quoted which testify to the striking results obtained.

L. V

697 — **The Food Plants of the Philippines.** — WESTER, P. I., in *The Philippine Agricultural Review*, Vol. XIV, No. 3, pp. 200-384, plates 35 × 1 map Manila, 1921

The number of food plants in the Philippines, and particularly fruits have been increased very considerably in recent years, partly by discovery of hitherto un-recorded, useful indigenous species, and partly through the introduction of exotics. A revised list has therefore been prepared for reference purposes.

A large collection of economic plants, including also annual agricultural crops, is being made at the College of Agriculture (University of the Philippines), Los Baños, Laguna, and it is expected that within a few years sufficient material will be available for wholesale distribution throughout the Archipelago. The information relative to temperate zone vegetables is

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OF PLANTS

based largely upon data accumulated at the Trinidad Experiment Station, Bagnio, Benguet, the Singalong Experiment Station, Manila and the Lamao Experiment Station, Bataan. According to recent reports, not including the 20 species of algae and fungi, 121 native species of nutritive plants exist in the Philippines and these in addition to the imported species, make a sum total of 444 species and sub-species, an increase of 76 over the list published in 1916.

Although rice, sugar cane, coconut, abaca, maize and tobacco occupy the first place, there are several less-known crops which are likely become important, e. g. the marang (*Artocarpus odoratissima*) and the bauno (*Mangifera coesia*).

Of the introduced and well-established species of tropical fruits, the coconut, banana, mango, mandarin, chico (*Achras zapota*), lanzon (*Lansium domesticum*) and papaya, are the most important, and the kamote (*Ipomeea batatas*), ubi (*Dioscorea alata*), gabi (*Colocasia esculenta*), mungo (*Phaseolus aureus*) and Cucurbitaceous plants, among the vegetables.

In the list given, which includes a description of each species, from the morphological standpoint, and notes as to respective economic qualities, certain points are of outstanding interest. The large number of species of the genus *Rubus* with edible fruits is worthy of attention, — viz. *R. copelandii*, *R. betulacifolius*, *R. ellipticus*, *R. elmeri*, *R. fraxinifolius*, *R. moluccanus*, *R. nigrobaccus*, *R. niveus*, *R. pectinellus*, *R. rolfei*, *R. rosaeifolius* etc. These are of especial value in plant breeding work, for hybridisation with temperate species with a view to obtaining a superior hybrid fruit adapted to the highlands and medium elevations. The existence of 4 distinct, edible fruited rattans is of interest, as well as the occurrence of 10 *Eugenia*s, 4 *Dillenia*s, and 12 *Garcinia* spp., natives of the Philippines. The maté (*Ilex paraquariensis*), native of Paraguay and Brazil which has adapted itself so readily to prevailing climatic conditions, and which is utilised as a beverage, resembling tea, appears to be an industrial crop of great promise.

It is worthy of note that *Hedyocarpus hutchinsonii*, one of the sources of chaulmugra oil (1), recently discovered to be a specific for the cure of leprosy, is a native plant which occurs fairly abundantly in certain regions. Apart from this species, there are many medicinal and dye plants, trees producing gums and resins and tanning extracts, and also fibre plants which are beyond the scope of this article.

It appears that the Philippines, in addition to being self-supporting from the agricultural point of view, lend themselves readily to an extension of the export of numerous nutritive crops, as well as fresh and preserved fruits of various kinds. Up to the present, the cultivation of certain valuable fruits has been too much localised, and consequently almost unknown in other parts of the country.

M. L. Y.

608 — Stigmas of certain Plants adapted to Germination of Sugar Cane Pollen. — See No 717 of this Review.

(1) See No 722 of this Review. (Ed.)



699 - Analysis of Fijian Wild Cane (*Saccharum officinarum*) var. (?), Roots of *Cordyline Terminalis*, Exudation from *Myoporum platycarpum*, and some Australian Fruits. - STEEL, T, in *Proceedings of the Linnean Society of New South Wales*, Vol 46 Pt 4, pp 487-491 Sydney 1921 Summarised in *The International Sugar Journal* Vol XXIV, No 280, p 213-14 London, April 1922

I FIJIAN WILD CANE (*Saccharum officinarum* [?]) — No use has up till now been made of the long slender cane known locally in Fiji as «Vico», which grows in abundance on the banks of the fresh water rivers. The author made an analysis of four different samples of the red and yellow varieties and at the same time also of the native cane called 'Anani' and the introduced variety Honolulu

	Sucrose		Reducing Sugars		Other organic Matter		Ash		Fibre		Water		Average weight per stalk in kg	
	%	%	%	%	%	%	%	%	%	%	%	%	kg	kg
Wild Cane														
• Red	3.33	1.68	1.00	1.68	1.37	1.56	1.59	1.30	22.48	18.46	70.89	75.80	0.38	0.61
• Yellow	3.16	3.27	0.97	0.74	1.71	1.58	1.75	1.55	26.15	27.08	66.80	66.38	0.45	0.51
Anani	10.88		0.52		1.73		0.62		15.54		71.52		—	
Honolulu	15.08		0.61		0.80		0.49		11.98		70.52		1.51	

2 ROOTS OF DRAGON TREE (*Cordyline terminalis*) — The roots contain a large proportion of inulin which during roasting becomes transformed into levulose, the roots then become soft and have the appearance of having been soaked in molasses. Apart from their recognised food value in Fiji, in some parts the roasted roots are fermented and a liquor distilled from them. The percentage composition of the roots gave for the raw material and roasted, respectively

	Levulose	Inulin etc.	Caramel etc.	Ash	Fibre	Water	Weight of roots in kg
	%	%	%	%	%	%	
Raw	3.32	30.19	—	0.86	11.59	52.98	1.64
Roasted	38.53	—	10.85	1.00	12.58	38.00	2.08
	40.49	—	6.93	1.26	14.06	38.64	1.30

3 MYOPORUM PLATYCARPUM — A dark brown sugary mass exuding from punctures in the tree made by insects was analysed and contained % mannitol 44.0, reducing sugars 5.4, insoluble, 40.8, ash 1.9 and water 7.9

4 AUSTRALIAN FRUITS — *Eupomatia laurina*, *Ficus macrophylla*, *F. Cunninghamii*, *Ficus rubiginosa*, *Polocarpus elata* and edible fig. On analysis the total sugar content (dextrose and levulose) was found to vary from 0.30 to 13 %, the seeds, fibre, pectose etc 3.40 %, the ash from 0.4 to 2 %

M. L. V.

700 - **Hydrocyanic Acid in Sudan Grass.** — SWANSON, C. O. (Professor of Agricultural Chemistry, Kansas State Agricultural College), in *Journal of Agricultural Research*, Vol. XXII, No. 3, pp. 125-129, tables 18 Washington, Oct. 15, 1921 (1).

In a previous paper the author has shown that hydrocyanic acid is obtained from green Sudan grass (*Sorghum exiguum*) by maceration and digestion in water, but the acid does not exist in the free state in the plant. Freezing which is generally considered to promote the development of this poison, merely bursts the green cells and thus facilitates the liberation of the acid. It was also shown that although in some cases poisoning had occurred, under normal conditions no poisoning took place.

In view of the importance of the question, the author undertook further investigations and adopted the Prussian-blue method of analysis. One objection to colorimetric measurements is the difficulty of obtaining a uniform colour and the precipitate was very often quite green. However, apart from this objection this method is the simplest in practice. Calculations are based upon approximately 200 gm. of green material, not taking into account dry matter. When the plant was wilted or dry, the weight of the sample used was proportionately lessened. The sample was cut in pieces and a part macerated with or without sand. Distillation was made in a dilute solution of potassium hydrate or caustic soda. The proportion of hydrocyanic acid obtained was in every case very small and seldom more than 0.015 %.

Practically all the hydrocyanic acid was found in the leaves up to as much as 67 mgm. per sample, but none was found in well-developed stems. The younger plants contained more than the mature plants (60 mgm) and this may be attributed to stem development. If only the leaves are used the difference is much less, except when the plants approach maturity, and more is found in the summer than in the autumn. It may be assumed therefore that the hydrocyanic content is higher when the plant is in a vigorous growing condition, which confirms the theory of RAVENNA and ZAMORANI who state that hydrocyanic acid is an intermediary product between the nitrates and amino stage, which is followed by the protein stage. The maximum amount of hydrocyanic acid was obtained by maceration and digestion in water in room temperature for about 6 hours. After 2 or 3 days there was a decrease and finally the acid disappeared.

Even after the plant has been cut and during the hay-making, the acid may easily be obtained by the addition of hot water, but liberation of the acid is soon stopped. This change agrees with the above mentioned theory: when the plant has been cut, the absorption of nitrates is prevented and this stops the production of hydrocyanic acid. Certain experiments indicate the part oxygen plays in the phenomenon. Drying eliminates all the acid from the plant and renders it innocuous.

The green plant does not contain the free acid. If hot water or an acid is added no acid is forthcoming. On the contrary, the enzyme action is inhibited which induces the production of acid. Hydrochloric acid (even

(1) See R. Oct-Dec 1919, No 1104. See also No 728 of this Review (Ed)

from gastric juice) paralyses the enzyme action and hence there is no danger with green plants. A similar action results with the alkalis. It should be noted that Sudan grass contains less hydrocyanic acid than sorgho or kafir.

L. V.

701 - **Vitamine Content of Vegetable Oils.** — DRUMMOND, J. C. and ZILVA, S. S. (Biochemical Laboratory, Institute of Physiology, University College, London and Biochemical Department, Lister Institute, London) in *Journal of the Society of Chemical Industry*, Vol. 41, No. 8, pp. 125-127. London, April 29, 1922.

It is a recognised fact that vegetable oils and fats contain a very limited proportion of soluble vitamins or vitamins A, and in some cases the larger number of these oils are completely deficient, which renders them of much less nutritive value than animal fats, especially butter.

The object of the present investigations is to discover whether it is possible to obtain vegetable oils of a comparatively high vitamin value. Although much still remains to be done as regards this question, the results obtained are of interest. The examination has been made on behalf of the Medical Research Council with the assistance of two commercial firms and also the Imperial Institute, South Kensington. The subject of these tests presents certain difficulties, which cannot be dealt with *in vitro*, but only *in vivo*, as the chemical reaction of vitamins is unknown. It has been necessary to employ a large number of animals, such as rats etc.

In a preliminary series of experiments the author tested the vitamin content of various fruits and seeds utilised for oil extraction, in order to discover if they were of low value and if extraction impoverished them. Previous experiments (MCCALLUM, DRUMMOND, and COWARD) gave negative results; further tests were therefore necessitated and twenty varieties of seeds were examined. Animals were fed on rations deficient in vitamin (basal diet) and consequently a hindrance to development, and fixed quantities of seeds were added to see if this would to a certain extent supply the deficit. The interpretation of results was not always easy; for example, certain seeds, such as cotton, have apparently a toxic effect, and this has been attributed wrongly to lack of vitamin.

Taken as a whole, oil seeds evidently lack vitamin A; the vitamin content in the leaves is not transported to the seeds.

Cotton seed and kapok proved toxic; white maize, soya beans, etc., entirely deficient; arachis, sesame, yellow maize etc.; low content; palm kernels, rape; very low; only linseed possessed any appreciable value, as already noted by MCCALLUM; a daily supplement of 2 gm. produced practically no growth; but 4 gm. gave slow but steady growth of the animals tested.

The low vitamin content in oil seeds encourages the idea that crude oils are equally impoverished and it was decided to investigate this question. To avoid oxidation, which might have an inhibitive effect on the vitamin, oil extraction was made by petroleum spirit (b. p. 40-60° C) at low temperature and pressure, the last traces being removed by a current of CO<sub>2</sub>. It appears that the vitamin is carried over into the extracted oils, which

confirms previous observations made by the authors concerning the vitamine content of certain crude commercial oils, although concentrations were invariably low. As a rule 1.3 gm. of crude oil supplied daily to the animals gave a very slow rate of growth. Average butter, on the contrary, at the rate of 0.2 gm. and cod liver oil (high vitamine A content) gave excellent results.

A low vitamine content of refined linseed oil has however been reported. It is not feasible that the vitamine was destroyed by oxidation. Probably a portion still remained with the seed in a form difficult to extract by solvents. The vitamine remains in the seed even after mechanical extraction; in fact the commercial refined linseed oil is deficient in vitamine. The problem requires further study.

The high vitamine value of crude palm oil from the African fruit was shown by DRUMMOND and COWARD and is deeply coloured with carotene and xanthophyll. Certain examples somewhat resemble butter, which recalls the suggestion advanced by STEENBOCK that the vitamine A is associated with pigments of the lipochrome class. This theory is therefore inexact, but it is nevertheless true, especially with many vegetable products, that vitamine A is frequently associated with these colouring matters.

An attempt was made to prepare from crude palm oil a fraction unsaponifiable and it was found that this product possesses a high vitamine content: care was necessary to avoid oxidation during saponification. The authors have not been able to use to any extent this fraction for raising the vitamine value of vegetable oil margarines, since the product was unpalatable. Further investigations are necessary if the unsaponifiable constituents are to be treated successfully in order to obtain a utilisable economic product.

L. V.

702 - **Changes in the Composition of Pepper (*Capsicum annuum*) during the growing Period.** — SIEVERS, A. T. and MCINTYRE, J. D. (Bureau of Plant Chemistry, U. S. Dept. of Agriculture), in *The Journal of the American Chemical Society*, Vol. 43, No. 9, pp. 2101-2104, Easton, Pa., Sept. 1921.

The change in chemical composition of the plant (fruit, root etc.), during growth has very often been studied, and in addition to being an inviting field of research from the scientific standpoint, it possesses also a practical interest, as it serves to show at what stage of growth a product should be harvested in order to assure maximum quality and yield. This is the case with the development of sugar in the sugar beet, sweet potato, sweet maize, orange, citric acid in lemon; volatile oils in aromatic herbs and alkaloids or other active principles in medicinal plants.

Much work has been done on the chemical composition of the paprikas but more especially with the variation between the several parts of the fruit or the effect of the addition of foreign matter on its composition. No systematic study of the chemical changes up to maturity has been made. The author has selected a variety of *Capsicum annuum* L. a large fruited

red and pungent variety (1) and traces the development of the pungent principle at various stages of growth. Six different sizes of fruit were picked: the smallest measured 2.5 cm. length and less, the largest more than 10 cm. The colour varied from green in the first 3 sizes, to dark red in the largest size. The fruits were carefully cleaned and dried, calyxes removed and the dry pods then ground and analysed.

Taken as a whole the total sugar percentage varied only slightly (11.9 to 14.39 %, 5.81 to 8.59 being reducing sugars), which does not show any definite change during ripening. The same may be said of the alcohol extract (from 18.72 to 72.15 %) and the ash (8.13 to 6.78 %, practically all soluble). Ether extract is a fairly accurate measure of maturity (2.14 to 9.18 %), also the volatile ether extract (0.19 to 0.85 %) and the non-volatile extract (1.95 to 8.33 %). In the first case the increase was especially marked at the end of the growing period, rising from 0.24 to 0.85 % between stages 5 and 6, an excellent indication of the stage of maturity. In some cases it will be necessary to use the normal ether extract for comparison purposes.

As a means of determining roughly the relative pungency of the pepper, it has been proposed that the quantity of sugar required to neutralise the characteristic pungency be determined. In the experiments in question, the quantity increased with the development of the fruit; for 0.2 gm of pepper from the first to last stage, from 0.39 to 32.2 gm. of sugar was required. From stage 5 to 6 an increase from 12.48 to 32.2 gm was necessitated.

It should be noted that the maximum value is obtained with fully matured fruit, that is when the colour is dark red, although the colour of the pepper is in reality of no great importance. L. V

#### 703 - Action of Selenium on Plant Growth and Modifications due to Radio-Activity. -

STOKLASA, J., in *Comptes rendus des Seances de l'Academie des Sciences*, Vol 174, No 10, pp 1256-1258 Paris, May 8, 1922

Six different species of plants were under observation viz. *Hordeum distichum*, *Zea Mays*, *Polygonum Fagopyrum*, *Vicia Faba*, *Soja hispida*, *Lupinus angustifolius*. Sodium selenite proved harmful to development at concentrations of  $5 \cdot 10^{-2}$  to  $5 \cdot 10^{-6}$  of molecular weight expressed in grammes, per litre of nutritive solution. This injurious effect increased with concentration. Sodium selenite, used in equal proportions proved far less toxic, and it appears that if further diluted ( $0 \cdot 6^6$  to  $5 \cdot 10^{-5}$  P M), it encouraged plant development, especially with the maize. The injurious effect of selenite was either widely distributed or almost entirely neutralised by radio-activity, supplied in the form of radio-active water at the rate of 0.0000056 mg. of radium per plant per day, in pots containing 3500 cub. m. of nutritive liquid, with  $5 \cdot 10^{-4}$  P. M. of selenite per litre. The experiments

(1) As a rule the *C. annuum* varieties are not pungent and this belongs rather to *C. nutescens*, *C. baccatum*, *C. indicum*, *C. longum*, with small fruits. In Italy they are known as "peperoncini diavoletti" from which the red or Cayenne pepper is obtained. The fruit and powder are also sometimes called by the Hungarian term paprika. (Ed)

lasted for 12 to 15 weeks. As an example, after 99 days, from *Hordeum distichum* was obtained 22.09 gm. organic matter without emanation and 50.03 gm. with emanation.

A similar effect has also been noticed with germination. This may be attributed to the oxidising influence of the emanation which changes the selenite into seleniate, which is less toxic, but the author considers it more probable that other reactions take place which may modify intracellular changes, with or without the intervention of chlorophyll.

To ascertain the dynamic force of radio-activity, it is to be noted that a similar action is exercised by light. Thus, selenous anhydride is much more toxic to plants than sulphurous anhydride, in the present experiments, a dose at the rate of 0.001 : 100 volume, killed all the plants in 1 to 2 hours, whilst the sulphurous anhydride had hardly any effect. If, however, the selenious anhydride is used in the presence of light, it proved less active. At 0.00005 it no longer destroyed the chlorophyll with the same facility and arrested photosynthesis less than the sulphurous anhydride.

The explanation of this fact is simple, light exercises a reducing action on soluble selenium compounds and transforms them into inert colloids (the selenium alone is not injurious to plant growth, as it is insoluble). Radio-activity both favours and induces this protective reaction.

The living cell possesses therefore the faculty, under the action of light and especially under the influence of radio-activity, of reducing and rendering inactive the soluble selenium compounds. The author has carried out experiments to demonstrate these reactions I. V.

704 - **Growth and Correlation in Sea Island Cotton.** — MASON, T. G. (Economic Botanist and Acting Assistant for Cotton Research, Imperial Department of Agriculture for West Indies), in *West Indian Bulletin*, Vol. XIX, No. 2, pp. 214-230, figs. 9, bibliography of 6 works. Bridgetown, Barbados. March 31, 1927.

Investigations undertaken to ascertain the relation existing between growth processes in one part of the cotton plant and other neighbouring parts as a guide to agronomists and plant breeders in future work. The experiments were conducted at the Experiment Station, St. Vincent with a variety isolated by HARLAND, well adapted to the prevailing conditions in St. Vincent. Every possible facility was given for free development and for light to reach the lower fruiting branches. The development of the central axis system of branches was studied in two groups of plants from one of which the vegetative branch systems were removed.

After a brief survey of the arrangement of the branch system of the Sea Island Cotton plant, the author gives detailed notes as to the fate of axis elongation, of node production and of flower bud production for both pruned and unpruned plants, illustrated by curves representing the computed values.

It was found that in all three cases the rate had a distinct tendency to approximate closely to the course of an auto-catalytic reaction. It was clearly shown, however, that the mere correspondence between the observed and computed values could not warrant the conclusion that growth was



After the first choice in the plantation it is essential to select well developed specimens with an abundance of leaves, with blades measuring at least 170 cm. in length. Special attention should also be paid to the flowering period, the final biological phase in the life history of the plant, and late flowering specimens should be noted.

As regards longevity, the following periods have been notified: —

	years
On the plain (red soil) . . . . .	4
On coral reefs . . . . .	10
At a height of 1400 metres . . . . .	6
In the Hawaii Isles . . . . .	7-9
In Cuba . . . . .	15
In the Bahamas . . . . .	6-12

The fibre content varies from 1.8 to 4.8 % and appears to be independent of the stage of maturity of the leaf, age of the plant, etc. With reference to strength of the fibre, determined by traction, out of 5272 trials, it is estimated that a bundle of fibres 20 cm. in length, will resist a weight of 2399 gm. In certain cases a maximum of 4500 gm. has been reached. The strength of the fibre is independent of manurial treatment.

From each selected specimen, 12 to 20 leaves are gathered, weighed and preserved in water until their weight remains constant, that is to say, until imbibition is complete. The fibre is then extracted, dried and weighed, and the weight calculated in relation to the weight of the leaf impregnated with water, assuming the latter to equal 100. The best plants are propagated by means of small bulbs and the ensuing generation should be compared with the mother plant.

G. A.

707 - **Yellow Stripes on the Leaf a Hereditary Character of Maize.** — DEMEREC, M., in *The Journal of Heredity*, Vol. XII, No. 9, pp. 400-407, figs. 1. Washington, D. C., Nov. 1921.

The zebra striping is not evident at the early stages of growth. It forms part of a group of characters due to a gradual decrease in the quantity of chlorophyll, a decrease accentuated with the age of the plant.

The first symptom is the appearance of yellowish spots; these spread gradually finally uniting to form characteristic transverse stripes.

Specimens of this kind were observed for the first time in the  $F_3$  of "California Rice"  $\times$  "Tom Thumb p. p.". Crossings made with the normal type indicated that the character in question is Mendelian and recessive as regards the green coloration.

G. A.

708 - **Manitoba Wheat in Algeria.** — DUCELLIER, L. (Professeur à l'Institut Agricole d'Algerie) in *Revue agricole de l'Afrique du Nord*, Vol. 20, No. 137, pp. 170-171, figs. 1. Algiers, March 17, 1922.

The various Manitoba wheat varieties have been isolated by the author and kept under observation at Maison-Carrée. They number 15 and belong to 4 species; bearded and beardless; soft bearded and beardless



soft with dense ears, and hard, beardless. The beardless soft wheats with white or red ears predominate.

The chief defects associated with the Manitoba yield in Algeria are the lack of uniformity and the excess of poor and brittle grains which renders the sale difficult in contrast with what happened in France, where its good milling qualities were appreciated.

The Manitoba wheat is suitable for late sowings ; it grows rather more rapidly than the tender Algerian wheats, sown out of season, and from the point of view of quality, the Marquis variety, also isolated by the author, is preferable.

F. D.

709 — **Experiments with Fodder Plants in South Africa, and their Chemical Composition.** — SKIBBE, A. and SELLSCHOP, P. F. (School of Agriculture and Experiment Station, Potchefstroom), in *Journal of the Department of Agriculture*, Vol IV, No. 4, pp. 338-340, plate 1, bibliography of 5 works. Pretoria, April 1922.

FORAGE CROPS,  
MEADOWS  
AND PASTURES

The various chemical changes which take place as a result of over-drying have a natural tendency to make fodder plants less digestible, and the method of storing and mechanical condition of the grasses affects to a certain extent the availability of the nutrients. This is demonstrated by the analytical data derived from analyses made in South Africa with Kikuyu grass (*Pennisetum clandestinum*) indicating a decided variation in composition.

The authors give a summary of the origin, morphological characteristics, habit, propagation, type of soil required, uses and average yields of the best known forage crops, viz. dhal bean (*Cajanus indicus*), chick pea (*Cicer arietinum*), *Sesbania aculeata*, tick bean (*Vicia faba*), peanut (*Arachis hypogea*), Sudan grass (*Sorghum Sudanese* Stapf) and napier fodder (*Pennisetum purpureum*). The appended Table gives a summary of the cultural methods associated with these crops in a compact and complete form very useful for reference. An equally interesting table shows the chemical composition of these plants, both of the green, and air-dried samples, water-free basis analysis, and of the concentrates obtained through chemical analysis of the seeds.

M. L. Y.

710 — **Lucerne in Tucumán, Argentina.** — SCHVELTZ, T. F., in *Revista Industrial y Agrícola de Tucumán*, Vol XII Nos. 1 and 2, pp. 17-32, figs. 4. Buenos Ayres, 1921.

For several years the "Estación Experimental agrícola" at Tucumán has carried out experiments with different varieties of native lucerne from Mendoza, Prov. of Salta, Catamarca, San Juan, Prov. of Buenos Ayres, Médanos, Santiago, etc. and has introduced varieties from Grimm, Peru, Dakota, Utah, Kansas, Arizona, California, Colorado, Germany, Italy and Turkestan.

In the early comparison trials, the Peru lucerne proved superior to all others and the Experiment Station ordered from Peru in 1919, 15 tons of seed for distribution to farmers, who reported later satisfactory results. In 1920, the introduction of new seeds from Peru became impossible owing to trade restrictions. The Tucumán Station had however succeeded in obtaining a new type of lucerne, quite different from the Peru variety but

of good quality, — well developed, high yield and a frequent cropper during winter, hence the name "alfalfa invernal". A sowing made at the end of July 1919, on irrigated plots gave 2 crops in 1919, from January to December 1920, 99 060 kg of green fodder was obtained from 9 croppings. Under the same conditions Peru lucerne gave 106 160 kg for 9 croppings; Dakota lucerne 90 371 kg for 8 croppings. In 1921 the figures were respectively 8 croppings 100 880 kg, 9 croppings, 85 080 kg, 7 croppings, 90 221 kg, 7 croppings 84 279 kg.

Sown in unirrigated plots early in June 1920, 2 crops were obtained in 1920, and 7 in 1921 growing 69 750 kg of green fodder per hectare. The common lucerne gave 54 800 kg in 5 1/2 croppings.

The Tucumán Station has undertaken the distribution by sale of this new variety of lucerne F D

711 - Grasses of Agricultural Value in Southern Rhodesia. — MUNDY H G, BLACKSHAW, G N and BLACK F V in *The Rhodesia Agricultural Journal* Vol XIX No 2 pp 134 149 tables 1 Salisbury April 1922

PART I — DESCRIPTION AND FIFTH CHARACTERISTICS — For about 12 years the Department of Agriculture in Rhodesia has been making investigations with the object of introducing grasses, which by their hardiness and drought and frost resisting qualities would furnish improved pasture during the winter months. It has been suggested however, that with very few exceptions the better known and more valuable grasses from other parts of the world have not proved satisfactory in Rhodesia. Similar experiments made with African and especially with the more promising Rhodesian species gave on the contrary very encouraging results, 55 native species or sub-species 10 African species (not known to be native to Rhodesia), 10 species survivors of exhaustive trials of recent introductions whose value has not yet been determined, are under observation at the Salisbury Experiment Station.

The authors describe the grasses in such a way as to enable the farmer etc to identify the species which up to the present have proved the most successful and will repay the cost of introduction. The identity of all the species referred to has been established by the Director of Royal Botanic Gardens Kew —

INDIGENOUS Rhodesian Tussock Grass " (*Setaria Lindenberghiana*) valuable for dry lands ' Peuhlonga grass ' not identified botanically, it has never yet flowered on the experimental plots and flowering specimens have not yet been procured, cattle and sheep appear to be very fond of this grass, False Paspalum' (*Bracharia brigantha*) of two types, one broad-leaved and the other fine-leaved ' Swamp couch Grass " (*Hoemarthria fasciculata*), valuable on water logged pastures, " Fine Guinea Grass " (*Panicum maximum*), much liked by stock either cured or fresh (as much as 15 tons per acre has been obtained) Buffalo grass " (*Setaria sulcata*), grows wild in damp and sheltered places and has been found equally successful on dry soils, relished by stock and of high feeding value, " Golden Timothy Grass " (*Setaria aurea*) (= ' Rhodesian Timothy '), abun-

dant on heavy wet soils in Rhodesia; "Red Rhodes Grass" (*Eustachys petrea*), "Antelope grass" (*Echinochloa pyramidalis*), "Tall Couch Grass" (*Cynodon Dactylon*), "Native Paspalum" (*Paspalum scrobiculatum*), "Common Red Top Grass" (*Tricholaena rosea*), "Bristle Leaved Red Top" (*T. setifolia*).

EXOTICS. "kikuyu" (*Pennisetum clandestinum*), introduced 5 years ago from Kenya Colony, and tested on a considerable scale; it is not recommended to leave kikuyu pasture for more than 3 to 5 years. It is especially suitable for sheep and there is no difficulty in getting rid of this grass; Natal Grass (*Pennisetum unisetum*), makes good growth; can be used as hay; during the rainy season, it reaches a height of 4 to 4 ½ ft.; "African Star Grass" (*Cynodon plectostachyum*); moderate resistance to drought and frost, "Perennial Canary Grass," recommended, high feeding value, little affected by frost, requiring however good land and irrigation, "Upright Paspalum" (*Paspalum virgatum*), grows to a height of 3 to 4 ft., somewhat coarse and like other similar species, subject to ergot; "Rhodes Grass" (*Eustachys gayana*), good results if irrigated and in India it has given excellent results as irrigated forage.

PART II. -- CHEMICAL COMPOSITION OF GRASSES. — Analyses of 24 grasses grown on a red loam at the Agricultural Experiment Station, Salisbury, have been made at the Chemical Laboratory of the Department of Agriculture. Some of the more important results are shown in the following Table. The samples were taken before and after flowering.

Name	Moisture %	Fats (ether extract) %	Crude protein %	Carbohy- drates %	Crude fibre %	Ash %
AIRDRIED SAMPLES.						
<i>Panicum maximum</i>	10.04	1.61	10.94	36.04	32.60	8.77
<i>Setaria sulcata</i> . . .	9.81	1.91	13.31	37.80	27.38	9.79
<i>Setaria aurea</i> . . .	8.30	2.62	14.12	36.74	26.73	11.49
<i>Brachiaria brizantha</i> .	9.48	1.95	10.25	35.79	33.07	9.46
<i>Eustachys petrea</i> . .	11.25	2.98	10.25	39.46	28.25	7.81
<i>Echinochloa pyrami- dalis</i> . . . . .	9.22	1.83	11.37	36.24	32.86	8.48
<i>Cynodon plectosta- chyum</i> . . . . .	9.78	1.60	8.62	48.07	26.52	5.40
HAYS.						
<i>Paspalum scrobicu- lum</i> . . . . .	10.38	1.95	7.00	45.88	27.13	7.66
<i>Pennisetum unisetum</i>	7.82	1.49	7.31	40.16	34.20	9.02
<i>Brachiaria brizantha</i>	10.29	2.33	8.44	41.44	26.75	10.75
<i>Choris Gayana</i> . . .	8.43	2.07	8.50	38.47	33.09	9.44
<i>Setaria aurea</i> . . .	8.57	1.51	6.25	36.83	36.62	10.22
<i>Tricholaena rosea</i> . .	7.58	1.59	5.69	41.52	36.82	6.80
<i>Paspalum virgatum</i> .	8.90	2.20	4.69	42.60	34.97	6.64
<i>Tricholaena setifolia</i> .	8.93	2.31	5.81	40.31	34.85	7.79

F. D.

[121]

712 - *Pennisetum purpureum* as a Forage Crop. — BRÜNNICH, J. C., in *Queensland Agricultural Journal*, Vol XVI, No 1 fig 1, pp. 6-8. Brisbane, 1921.

The Australian farmers have recently proved the value of Elephant grass or Napier grass (*Pennisetum purpureum*) as a forage crop. This plant is a native of Africa which crops heavily, and is very resistant to drought and has apparently an excellent nutritive value at all stages of development.

In order to confirm this reputation the author examined a number of samples collected in various districts and at different seasons. The results of the analyses indicate clearly that only the young plants should be considered as fairly good quality forage, and that the feeding value becomes less with age and is very low when finally mature.

With *Pennisetum* as with the larger proportion of Australian forage plants, the protein content is low, and as the proteins constitute the essential element in meat production, it is advisable to supplement this feed with a certain quantity of concentrated foods, such as bran, cottonseed cake, etc.

All the samples examined were tested for hydrocyanic acid, but the results were invariably negative. As regards this question, attention is called to the fact that other forage plants (*Sorghum* spp.) possess a hydrocyanic content at certain stages of growth (1) and that generally the toxicity decreases to a considerable extent with age.

E. F.

#### FIBRE CROPS

713 - Experiments in the United States with Meade Cotton, the Upland Long Staple Variety to Replace the Sea Island Variety. - MELOY, G. S. (Bureau of Markets) and DOYLE, C. B. (Bureau of Plant Industry), in *United States Department of Agriculture, Bulletin* No. 1030, pp. 1-24, tables 5, pl. 10, bibliography of 14 works. Washington, D. C., March 10, 1922.

Owing to the spread of the boll-weevil (*Anthonomus grandis*) in the south-eastern United States, the production of the valuable fibre obtained from the Sea Island cotton has been on the decline. The late maturity etc. render this variety peculiarly susceptible to attack, and although experiments have been made to develop earlier strains, no practical results have been obtained.

The value, however, of a new variety of the Upland type has in recent years been clearly demonstrated. The early-maturing long stapled variety "Meade" has given promising results and where definite comparisons have been possible it has produced at least twice as much as the Sea Island cotton, and appears to be comparatively immune to boll weevil attacks. For example — in one badly infested area, the Meade yielded at the rate of 1499 lb. of seed cotton per acre and the Sea Island at the rate of 501 lb. Similar results have been since obtained elsewhere in the States.

The production and maintenance of an adequate supply of pure seed has been found to present difficulties. Communities of farmers are being encouraged to co-operate with ginners to provide the necessary facilities for dealing with these difficulties, and the question is receiving careful attention.

(1) See No 700 of this Review (Ed.)

During 1920, a publicity campaign was conducted in Georgia (1), which has gone far to increase the popularity of the Meade cotton.

Spinning tests of the Meade fibre in comparison with both the Sea Island and Egyptian cottons have shown that the difference between these fibres, especially in the finer yarns is so slight as to be practically negligible. Although the percentage of waste for Meade fibre is somewhat higher, this may be overlooked, as the waste may be reduced by slight adjustments made in the spinning machinery.

M L. Y.

714 - **The Behaviour of Pima Cotton when Grown under different Conditions of Soil Moisture and Available Plant Food in the United States.** KING, C J (Office of Biophysical Investigations) in *United States Department of Agriculture, Bulletin No 1018*, pp 1-21, tables 8, bibliography of 21 works Washington, D C, March 15, 1922

Although the experiments conducted in Arizona U S. A. do not suggest a satisfactory method that can be recommended for general practice, the author considers that some of the resulting data are of sufficient importance as to be worth recording for the use of other investigators and the public in general.

These experiments were made in Phoenix (Ariz) on a heavy clay loam with a subsoil of coarse sandy loam, inter-spersed at a depth of 5 to 6 ft with calcareous material. Plot I was irrigated at intervals with a view to maintaining during plant development a constant supply of available moisture at the rate of an approximate increase of 7% in the upper 2 ft of soil. Plot 2 was irrigated shortly before the exhaustion of all available moisture in the upper 4 ft soil, at the rate of 5½% increase and Plots 3 and 4, were irrigated when this applied to the upper 5 ft of soil at the rate approximately of 4% moisture increase.

To determine whether the supply of plant food was in any way correlated with the water requirement, cottonseed meal and 16% acid phosphate was applied to plot 4 at the rate of 500 lb per acre.

Judging by the results obtained it was ascertained that there is apparently no relation between soil-moisture conditions and the period of boll development. In addition the data indicate that the heavy application of fertiliser containing 10% available phosphoric acid had a negligible effect on the rate of maturity.

There appears to be an important relation between the increase of shedding rate (based on the number of bolls available for shedding) during the first two months of the flowering season, and the gradual reduction of the moisture content in the sub-soil. The mean interval between the opening of the flower and the completion of shedding was approximately 10 days, but this varied with weather conditions.

Plants watered soon after the first flowerbuds began to form, and then at frequent intervals, produced a greater stem growth and number of flowers during the first 45 days of flowering than plants which received water 16 days later. Plants on soil watered sparingly throughout the seas-

(1) See, 'Meade Cotton', published by the Georgia Breeder's Association (1920) (Ed)

on produced a larger number of bolls late in the season than when water was applied in larger quantities. By October the highest "potential seed-cotton production" per plant was on Plot 3, while the highest actual yield was obtained on Plot 1.

The data indicate that attention should be directed to the fullest possible stimulation of comparatively early fruit setting, especially where there is a tendency to early frosts, as the number of bolls set during this period largely determines the extent of the crop. There are indications that an internal physiological reaction results from prolonged lack of water in the plant tissues, which tends to inhibit their response and recovery under favourable conditions during later development. M. L. Y.

RUBBER GUM  
AND  
RESIN PLANTS

- 715 - Rubber Content of North American Plants. Special Investigations with the *Asclepia* spp. and *Apocynum* spp. - HALL, H. M., and LONG, F. L. In *Carnege Institute of Washington, Publication No. 313*, pp 1-65, tables 14, plates 3, bibliography of 19 works. Washington, D. C., 1921

The purpose of the investigation was to make a preliminary study of the rubber content of various North American plants from the point of view of scientific interest and to find if possible, some latex plant sufficiently promising to justify cultivation as a rubber producing crop. The present studies here reported are concentrated chiefly on the value of *Asclepias* (Milkweeds) and *Apocynum* spp. (Indian hemp), and similar plants in which the rubber occurs in the form of emulsion in the latex. The work described in this paper is a continuation of the survey begun as a war emergency project under the State Council of Defense in California (1), which centred especially round the rubber value of *Chrysothamnus* and *Haplopappus* spp. (the rubber in this case, however, occurs in the form of solid particles in the plant cell, and not in the latex).

Altogether some 225 North American species have now been examined and a record made as to the presence or absence of rubber in their tissues. About 6 species of shrubs and 16 species of latex-bearing herbs are considered worthy of further study and experiment.

The authors gives a resumé of earlier investigations made, but considers that with the exception of *Castilla* and guayule (*Parthenium argentatum*), former researches have not obtained sufficiently definite results to establish an estimation of the respective rubber value of the various species examined. The present investigations here reported, have, however, extended the work to diverse species and to other ecologic and genetic forms of the species examined hitherto, and a much more definite basis for further work and possible cultivation of certain species, has been established.

The acetone-benzene method of analysis was employed; the rubber percentages determined represent therefore, material practically free from resin or other admixtures. The data are based upon the dry weight of the material analysed.

(1) HALL, H. M. and GOODSPEED, T. H., Rubber Plant Survey of Western North America. *University of California Botanical Publications*, No. 7, pp. 159-178, 1919. (Ed.)

*Asclepias* spp. — The perennials described die down near the base each year, new shoots appearing at the beginning of the following growing-season. These are distinct from the milkweeds with woody stems.

The plants grow rapidly from seed and from portions of the root, and it should be noted that the plants are found to have made good growth on land considered so poor and dry that it is not at present utilised for cultivation purposes.

The plants examined appear to contain a much higher percentage of rubber in the leaves than in the stems or roots. The one exception was a nearly leafless desert milkweed (*Asclepias subulata*) the stems of which contain from 2-6.4 %. This is a species of outstanding promise. Others considered of special interest owing to the rubber content of their mature leaves are :

*Asclepias brachystephana* 2.1 to 2.9 %; *A. californica* (= *Gomphocarpus tomentosus*), 2.6 to 4.3 %; *A. galioides*, 0.6 to 5.2 %; *A. latifolia* (= *A. jamesi*), 2.0 to 3.8 %; *A. mexicana*, 1.4 to 4.8 %; *A. speciosa*, 1.0 to 3.0 %; *A. sullivanti*, 1.2 to 8.1 %; *A. syriaca* (= *A. cornuti*), 1.1 to 4.4 %.

*Apocynum* spp. *A. cannabinum* (Indian hemp) and *A. androsaemifolium* (Spreading dogbane) showed on an average from 0.7 to 5.1 % rubber content.

In addition to the above-mentioned species, 6 others are reported as worthy of consideration, although perhaps not of equally high value, viz. *Acerates auriculata*, *Asclepias criocarpa*, *Asclepiodora decumbens*, *Cryptostegia grandiflora*, *Jatropha cardiophylla*, *Hymenocys floribunda utilis*.

In every case the authors give full details concerning the morphological characteristics, distribution, and ecology of each species.

An additional list is given of species of latex plants with comparatively negligible quantities of rubber; but certain individual plants, amongst them contain a sufficiently high percentage to encourage further investigations.

Special attention has been given during the 3 years devoted to the studies here described, to the extent and cause of the variation in rubber content of the *Asclepias* spp. It has been ascertained that taking into consideration the evident numerous existing strains, it should be possible to develop those with the high rubber content, by breeding and reproduction. Detailed studies were carried out with several species to determine the presence or absence of a correlation between the age of the plant and its rubber content.

Results indicated that the total amount increases as the plant matures and decreases later, or, in the case of stems, as lignification sets in.

*Properties of the Rubbers.* — The product obtained from *Asclepias* and *Apocynum* is considered as true rubber with only a small admixture of resins, fats, etc. Rubber prepared from the latter is probably superior to that from *Asclepias*. No thorough test has, however, yet been made of the rubber from either genus. The collection of material for the purpose of rubber extraction to permit of extensive tests, is now being undertaken.

*By-products.* — These in the form of fibre and paper pulp have been obtained from the residue after the extraction of rubber.

No opinion is expressed regarding the financial results that might follow from an attempt to grow the plants on a commercial scale. The author considers, however, that considerable scientific experiment should precede any such attempt. Sufficient data have now been accumulated to justify the recommendation that these experiments be now undertaken. In this connection should be considered those native shrubs in which the rubber occurs as solid particles and also various exotic shrubs and herbs, as well as indigenous species of *Asclepias* and *Apocynum*.

Up to the present the desert milkweed, *A. subulata* offers the best possibilities. This perennial grows rapidly on neglected areas, gives large yields which can be handled almost entirely by machinery, reproduces after cutting, and yields a paper pulp of better quality (43 % dry fibre and 28.5 %, bleached paper) than that from other species.

Much more extended and detailed investigation will be necessary before anything definite can be ascertained as regards the possibilities of these plants as agricultural crops, but the desirability of instituting further studies has most certainly been established.

M. L. Y.

716 — **Cover Crops on Young Rubber Plantations in Malaya, and the Advantage of Growing *Centrosema Plumieri* (Butterfly Pea) and *Mimosa invisa* (Giant Mimosa).** — SPRING F. G., in *The Agricultural Bulletin of the Federated Malay States* Vol. IX, No. 3, pp. 169-171 + 1 fig. Kuala Lumpur, July, Aug. and Sept. 1921

The growing of cover crops in young rubber plantations is at present receiving more attention in Malaya than it has ever done in the past, owing to the difficulties attached to clean weeding, etc. Certain objections are raised to the cover crop system, but the author considers that to avoid the difficulty of detecting harmful weeds growing amongst the cover crop, careful selection should be made of a suitable crop which should provide plenty of shade on the surface, but should not be tall-growing or woody in habit. In this way the extra cost of weed eradication etc. could be avoided. The objection raised as regards the spread of *Fomes* sp., root disease of rubber etc. and difficulties of inspection work, has been dealt with in conjunction with the Government Mycologist who states that unless diseased timber is to be found in a particular area the spread of fungous diseases will not be influenced by intercropping. Bad attacks of *Fomes* are merely local and need not be taken into account in dealing with the question as a whole.

In bringing out the obvious advantages of growing suitable cover crops, the author emphasises the fact that surface wash of soil is prevented. Hitherto the damage done by soil wash can hardly be over-estimated. The combination of this property of the cover crop with its utility as a subsequent green manure is of undoubted importance.

As regards the selection of cover plants, the two dwarf growing plants Giant Mimosa (*Mimosa invisa*) and the Butterfly pea (*Centrosema Plumieri*) are considered to be the most suitable for Malayan conditions.



*M. invisa*, is a remarkably strong growing plant and provides excellent shade over the ground. This will thrive where *C. plumieri* would prove a total failure. It has a beneficial effect on the physical nature of both light and heavy soils, and has been successfully used as a check for weed growth and in the eradication of the most injurious weed the "lalang" (1). Sowing is at the rate of about 2 lb. per acre and afterwards attention is limited to weeding at the early stages of growth, and thinning out round the base of the rubber trees. In Sumatra the crop is kept low by beating periodically with sticks.

*C. plumieri*. — This plant develops a large number of nodules on the roots and therefore serves also as a suitable green manure as well as a cover plant. About 4 lb. of seed are required per acre. Later the plant requires no further attention than the *Mimosa*. Although by nature a climbing plant, no difficulty is found in keeping it away from the rubber trees; when it is established, it will continue to thrive when the rubber is in bearing and there is no need to eradicate it when the tapping stage is reached.

It has been reported that *C. plumieri* does not thrive in wet or low lying situations. This plant is a prolific seed producer, and, if a relatively small area is planted, very shortly sufficient seed is obtained for planting comparatively large areas. The seed can be stored for several months without injury to germination. Although effective as a preventive of soil wash, the plant can only be cultivated with difficulty on eroded surfaces, and demands whenever possible a good top soil.

In addition to these two crops, it is noted that the Sarawak bean (*Dolichos Hosei*) and the horse gram (*D. biflorus*), have proved useful. The former does extremely well on light clays and soils with a good proportion of humus. This low growing leguminous creeper has done well amongst coconuts. It is always propagated from cuttings planted 3 ft. apart. *D. biflorus* has been used with advantage as a green manure but is not recommended as a cover crop as it occupies the land for a limited period only.

Several other leguminous creepers have been introduced into Malaya, but apart from their utility as green manure, their suitability as permanent cover crops is very questionable.

M. L. V.

717 - Germination and Preservation of Sugar Cane Pollen. — VENKATRAMAN, T S, (Government Sugar Cane Expert), in *Agricultural Journal of India*, Vol. XVII, Pt. II, pp. 127-132 + 1 plate Calcutta, March 1922

SUGAR CROPS

After numerous unsuccessful attempts to germinate cane pollen in artificial culture media, attention has been directed to growing the grains on live stigmas in the field, and the experiment was extended to stigmas other than sugar cane. After a series of trials, the stigmas of the following plants gave satisfactory results:—

*Datura fastuosa* var. *alba*, *Carica Papaya*, *Hibiscus vitifolius*, *Gynandropsis pentaphylla*. Ultimately *Datura* was selected as the standard and gave the most satisfactory germination; the flowers are also easy to

(1) *Imperata arundinacea*. (Ed.)

emasculate, the stigmás are ready long before the anthers open, and the stigmás remain in condition for a sufficiently long time when the bases of the flower-stalks are kept in water.

Details of the method adopted for testing viability are described.

As regards the preservation of sugar cane pollen, experiments showed that, if the pollen is kept in a moist atmosphere but with free access to the open air, it keeps viable for only a short time 1-3 hours, after which it loses vitality. Pollination should, therefore, be carried out as quickly as possible after the pollen has been collected.

A method is described by which sugar cane pollen could be preserved in a viable condition for as long as 11 days. M. L. Y.

718 - **Sugar Cane Varieties in Porto Rico** (1). - EARLE, F. S., in *Journal of the Department of Agr culture of Porto Rico*, Vol. V No. 3, pp. 1-141, bibliography of 23 works. San Juan, 1921.

The cultivation of sugar cane varieties especially adapted to certain soils and conditions, resistant to disease etc. is of ever-increasing importance. The excessive attention paid by sugar cane investigators to the discovery of new seedling varieties has led to the setting aside of old and hitherto important kinds, which cannot be regarded as advantageous. The author emphasises the desirability of continuing to test the older varieties until the adaptability of new seedling varieties to local conditions has been fully established.

In a previous paper (1) the author gave a description of different varieties of cane from the standpoint of their cultural value and characteristics. In the present article additional data are given for varieties already described, and others are also discussed and a brief outline is given of the history of cane varieties in Porto Rico. A paper entitled "An Annotated List of Sugar Cane Varieties" (*Journal of the Department of Agriculture of Porto Rico*, Vol. IV No. 3) which contains an alphabetical list of all the names applied to varieties in different parts of the world, was prepared as a part of this series of studies. This synonymous study has served to clear up a number of uncertainties as regards nomenclature.

The prevailing idea that old existing varieties are subject to deterioration in quality as been upset. The Caña Blanca or Otaheite cane has been quoted as an example but it has been proved that this variety described as "degenerated" grows on virgin land with its old vigour and that the failures recorded were attributable entirely to soil deterioration etc. Deterioration should not therefore be considered an inherent characteristic of cane varieties. This inherence does not, however, imply immutability and it is unfortunate that less attention has been given to the improvement of *existing* varieties through the selection of bad variations etc.

The Insular Station has recently carried out a considerable amount of chemical investigation to determine the effect on the sugar content of

(1) See *R* Jan 1920 No. 52 (*Ed*)

the juice, produced by the flowering and subsequent growth of the axillary buds. The results of the analysis of samples taken at different stages from a number of varieties show that on an average the flowering cane gives about 1 % more sucrose and 2 % higher purity than the non-flowering, and the percentage of reducing sugars is also appreciable less. These differences appear to be more marked early in the season. The conclusion is therefore drawn that flowering is not desirable in late varieties, nor in fields reserved for late cutting, but it is clearly of advantage for early canes.

The question of ripening in connection with prevailing conditions is considered and the effect of certain cultural methods. After cutting, it has been proved that cane deteriorates much more rapidly than when still standing in the field and the lack of attention to this fact has resulted in serious and unnecessary losses. The importance also of a comparative study of the keeping qualities of different varieties of cane is emphasised, and in this connection, the question of 'long ratooning', i. e. letting the ratoons from late spring harvesting remain until the beginning of the second succeeding harvest, thus allowing 20-22 months growth. The enormous yields so often reported from Hawaiian with yellow Caledonia var. have all come from these old canes, representing two seasons' growth. This question as regards several well established varieties requires careful consideration and study.

Details (and a key) are given for the different listed varieties both from the botanical and agricultural standpoint, and also for their economic value. The kinds mentioned in this list are adapted to any type of good cane land and may be planted either in the autumn or spring except when otherwise notified.

M. L. Y.

719 - **Tea Seed Production of Java and Sumatra.** — *The Dutch East Indian Archipel*, Vol. IV, No. 21, p. 222. Buitenzorg, Jan. 10, 1922.

In Java and Sumatra there are about 180 tea-seed nurseries belonging to some 134 owners. Together they cover an area of about 500 hectares and contain more than 630 000 seed plants. The majority are situated at a height of 1000 to 4000 feet, many seed-nurseries were laid out during the years 1901 to 1913. The 630 000 seed plants produced 8 600 maunds of seed in 1917, and when the nurseries have arrived at their full capacity for production this figure will have risen from 12 000 to 21 000 maunds, a figure which will probably be reached in 1923.

The import of seed from British India which amounted to 8 200 maunds in 1912-13, fell to 339 maunds in 1919-20, and now that there is no question of extending tea estates, the demand for seed is naturally very small. Demand is sure, however, to increase with the return of more prosperous times, but the large imports of former days can no longer be expected, and Java and Sumatra will probably have a considerable over-production of tea-seed.

The Tea Experimental Station is helping planters to lay out seed nurseries on a scientific basis. Generally the plants are too close and it is advisable to plant seedlings about 6 feet apart and to thin them out later.

STIMULANT,  
AROMATIC,  
NARCOTIC AND  
MEDICINAL  
PLANTS

Pruning should be judiciously done and moss and weeds removed, while digging, and manuring are generally unnecessary and often unprofitable because they promote the development of leaf-growth and delay the flower production. Seeds should not be gathered and only the fallen fruit should be collected, collection being made twice a week.

The laying-out of a seed nursery is specially to be recommended where an extension of an estate has been planned. If the object is to put the seeds on the market, the fact that overproduction is imminent must not be overlooked. If a seed-nursery becomes no longer profitable, the plants may be pruned off and used for gathering purposes. But if the nursery is situated at too great a distance, then there is no other remedy than to simply let the plants grow into a wood. The collecting of seeds for pressing oil is also worthy of consideration G. A. B.

720 - **General Survey of the Cultivation of the Vanilla Bean, and its Preparation for Commercial Use.** — STANISLAUS, I. V. S. (Consulting Chemical Engineer, New York), in *The Tea and Coffee Trade Journal*, Vol. 1., No. 4, pp. 528-532 and No. 5, pp. 671-678 New York, April and May 1922.

Although the common vanilla is recognised as *Vanilla planifolia*, it is noted that it is doubtful whether commercial vanilla is entirely derived from this species. The Mexican varieties of bean for example are obtained also from *V. sultensis*, *V. pomboia*, and *V. aromatica*, the Brazilian and Bahia beans from *V. gardneri*.

The author gives a summary of the geographical distribution of this plant the cultivation of which has extended from South America throughout the Tropics especially in Mexico, Seychelles, Réunion, Tahiti, Mauritius, Java, Fiji and the West Indies. The different values of the beans obtained from the various countries is discussed, with special details concerning the Mexican (1) and Guadeloupe beans. The actual production of vanilla beans for the season 1920-21, not including the Mexican has been estimated as follows — Madagascar and Dependencies 1 150 746 lb.; Mauritius, 1102 lb; Réunion 176 368 lb; Seychelles 6 614 lb.

The author gives a description of the botanical and also of the general characteristics of the plant and states that vanilla is suited to a hot, moist climate, if without excessive rains. Artificial fertilisation is as a rule necessitated owing to the fact that natural cross pollination by bees and humming birds is only possible in Mexico, and elsewhere bees rarely visit the flowers.

It is estimated that an average worker can fertilise 2 000 flowers per day if the plants are fairly close together.

*Methods of preparation and curing.* — A comparison is made between store curing; the last named is the most generally employed to secure uniform curing and each size is cured separately.

The best method of preserving vanilla beans for commercial purposes has been found to be storage in a temperature slightly higher than room

(1) See *R* Oct 1921, No 1008. (*Id*)

temperature : the idea of storage in ice-boxes or in cold cellars is no longer in favour DE GROOTE of the Mellon Institute of Industrial Research has recently stated that any system of storage permitting the air to circulate round the beans in the inner part of the bundle is to be recommended.

Attention is drawn to the sophistication treatment of collected beans occasionally practised, the most serious being the production of so-called vanillin crystals. On soaking the beans in a concentrated solution of benzoic acid in alcohol, after evaporation the crystals of the acid have a general appearance of vanillin crystals. Detection is possible, however, as the benzoic crystals are flattened and rhomboidal and generally lie flat upon the bean, while the others are generally needle-shaped and stand out at right-angles. It may be noted that the lack of crystalline coating is no proof of inferior quality of the bean. It has been stated on good authority that crystals are not infrequently entirely absent on the best Mexican beans. Other less notable forms of sophistication are also described.

As regards the chemical composition of the bean, the author describes the two ferments to be found in the plant, one as an oxydase in leaves, shoots etc. and readily extractable by water; the other as a hydrolysing ferment in the sap. Quite apart from the two kinds of resin also found in the bean, both are apparently necessary for vanillin formation, which is a coniferin derivative. The vanillin manufactured by oxidation of isoeugenol obtained from oil of cloves and from anisidin is of inferior quality to the extracts from vanilla beans. It is interesting to note that although Mexican beans show the lowest vanillin content, the quality of the extracts obtained is superior to that prepared elsewhere in flavour etc. The actual percentage content is shown in the following chemical analysis (HAARMANN): Mexican 1.69 %, Réunion 2.48 %, Java 2.75 %. M. L. Y.

721 - **Chaulmoogra Oil from *Taraktogenus Kurzii*, and its Medicinal Value as a Leprosy Cure** (1). - I. ROCK, J. F. (Agricultural Explorer of the Office of Foreign Seed and Plant Introduction, Bureau of Plant Industry, U. S. Department of Agriculture), Hunting the Chaulmoogra Tree, in *The National Geographic Magazine*, Vol. XL, 1, No. 3, pp. 243-270 + plates + 1 map Washington, D. C., March 1922 - II Chaulmoogra oil and Leprosy, in *The Agricultural News*, Vol. XXI, No. 518, p. 68-69 Barbados, March 1, 1922.

The value of chaulmoogra oil in the treatment of leprosy has for some years been recognised and it has given very good results. Two constituents of this oil, viz. chaulmoogric and hydnocarpic acids and especially their *ethyl esters* have proved effective.

As a result of the probably scarcity in the United States of this oil which is derived from *Taraktogenos Kurzii* King, the author was requested by the U. S. Department of Agriculture to obtain seeds of this species for introduction into Hawaii and other tropical possessions, where leprosy occurs, with a view to establishing chaulmoogra plantations. The report of the forthcoming expedition is here given (Pt. I).

(1) See R. Dec. 1917, No. 1166 (Ed.)

II. — A scientific discussion as to the chemical composition of this oil and its use in the treatment of leprosy patients. The oil seems to act as an internal disinfectant, killing the bacterial germs. Reference is made to the interest in this subject roused in the West Indies and it is also stated that efforts are being made to establish a *Taraktogenos Kurzii* tree in the Botanic Gardens, Dominica (*Annual Report 1920-21*). M. L. Y.

722 — **Alkaloidal Content of Leaves and Stems of Ipecacuanha from the Federated Malay States.** — *The Agricultural Bulletin of the Federated Malay States*, Vol. IX, No. 3, pp. 178. Kuala Lumpur, July Sept 1921

A sample of leaves of the ipecacuanha plant was forwarded to the Wellcome Research Laboratories, London, for analyses, and Dr. T. A. HENRY, the Director reports the following results.

*Leaves and stems* 1.5 % alkaloids, soluble in ether of which 0.45 % were emetine.

*Roots* of good quality contain 2 to 2 ½ % of alkaloids, soluble in ether, of which 0.5 to 0.75 % is emetine.

Dr. HENRY states that the discovery that the leaves contain emetine is interesting since there is no previous record on this point

As is well known the roots are a commercial drug. It is considered, however, that the collection of leaves might be injurious to the plants, and further investigation seems desirable. M. L. Y.

#### FRUIT GROWING

723 — **Cultivation of Lemons in Argentina.** RIVEROS, D., in *El Campo*, Vol. 6, No. 66, p. 165. Buenos Ayres, April 15, 1922

In the Argentine the provinces of Catamarca, La Rioja, Corrientes and the Northern areas are the districts particularly suitable for lemon growing. In the province of Corrientes, certain plantations of some importance are already established, but these have not been developed as much as was expected. Attempts have also been made elsewhere, but without success. For example, the fruit produced in El Tigre will not keep owing to the prevailing moisture in this area and to the high nitrogenous soil content.

As regards, insect pests, the scale insects which attack other citrus fruits are abundant in the northern part of the Republic owing to the lack of natural enemies. F. D.

724 — **Superior Italian Cherry Varieties.** — BRIGANTI, G., in *Italia Agricola*, Vol. 58, No. 11, pp. 301 + 1 table (col.) *Plaisance*, Oct. 15, 1921. Vol. 59, No. 5, p. 157 + 1 table (col.), May 15, 1922

Two excellent varieties of cherry are notified (1) and described viz.: "Cicalone" and "Zuccherina".

The first is characterised by vigorous growth, size, deep violet-red colour, acid flavour and small stone; the second by the well developed tree, the size, very sweet flavour, light ruby red colour, small stone, fine skin, and especially the early ripening of the fruit and consequently its appearance on the Naples market, as early as the beginning of May.

The fruits of these two varieties are not suitable for export, as the flavour and scent is only acquired when completely ripe. F. D.

(1) See R., Nov. 1921, No. 1124 (*Ed.*)

**725 - Plum Growing in California and Methods Employed for Drying the Fruits. —**

HENDRICKSON, A. H., in *College of Agriculture, Agricultural Experiment Station, Berkeley California, Bulletin* No 328, pp 1-38, figs 12 Berkeley, Ca., June 1921

Full details are given as regards the choice of stock, planting, irrigation, cultural operations, control of plant diseases and insect pests connected with plum orchards in California. The myrobalan stock is preferred to the almond and peach stocks, especially on deep moist soils. The two last named stocks are considered best on drier, gravelly soils.

As regards the curing process, most of the plums are sun-dried; although in recent years, an increasing proportion have been dried in evaporators (1). For sun-drying, trays holding about 60 to 70 lb. of green fruit are used. Approximately 1000 to 1500 trays and 250 to 350 lug boxes are necessary for 100 tons of fruit. From 10-14 days are allowed for this form of drying. In an evaporator the length of time varies from 12-72 hours, according to the size of the fruit, the temperature maintained and the type of evaporator etc. Although sun-drying has advantages from the point of view of cost and labour, the evaporation process ensures the curing of the entire crop, regardless of unfavourable weather.

A survey of the cost of production is made apart from the necessary additional equipment cost etc., which has shown an increase in recent years, owing to the price of labour. (The cost of cultivation, including ploughing, was probably at least 20\$ per acre). The prospective returns cannot be estimated with any degree of certainty.

It is calculated, however, that for the first 3 or 4 years, the orchard may be intercropped to provide a maintenance revenue; during the 5th and 6th years, the trees usually produce enough fruit to pay expenses and possibly to give a small profit. A fair crop for central coastal regions is estimated at 4-5 tons per acre, in the foothills, not more than 2 tons per acre, on deep fertile soils, inland, as much as 20 tons per acre have been obtained.

M. L. Y.

**726 - Price paid to Producer and Price charged to Consumer for Wood in France. —**

FORESTRY

ROULFAU DE LA ROUSSEIERE, in *Bulletin de la Société des Agriculteurs de France, Supplément au Bulletin d'avril 1922, Comptes rendus de l'Assemblée générale de 1922* fasc 2, pp 50-66 Paris, 1922

The author first shows the difficulty of ascertaining the price paid to the producer due to the lack of regular standards for the different conditions of the wood at which the price is quoted: standing, felled, either by the proprietor or the timber-merchant, but remaining where felled, felled and delivered at the timber-yard of the saw-mill or placed on the truck ready for transport; sawn only and delivered at the timber-yard of the saw-mill; delivered in the form of floor-boards, squared beams, scantlings, plants, laths, etc.

(1) For a technical description of evaporators see R. Aug. 1921, No. 858, R. Sept 1921, No. 953, R. Dec. 1921, No 1274. (Ed.)

The following, however, are some data as to the price paid to the producer and price charged to the consumer of *wood for working*:

Description	Gross value of the m <sup>3</sup> in fr.			Coefficient of increase		
	1914	1920	1922 (Febr.)	1914	1920	1922 (Febr.)
<i>Oak 0.45 m. in diameter</i>						
standing . . . . .	45	90	60	1	2	1.3
logs (unbarked) . . . . .	55	130	95	1	2.4	1.8
sawn . . . . .	79	241	185	1	3	2.3
<i>Beech, 0.38 m. in diameter</i>						
standing . . . . .	25	60	35	1	2.4	1.4
logs (unbarked) . . . . .	35	100	65	1	2.6	1.9
squared and cross beams . . . . .	50	170	124	1	3.4	2.5
<i>Fir</i>						
standing . . . . .	22	75	35	1	3.4	1.6
logs (unbarked) . . . . .	30	110	65	1	3.7	2.2
sawn . . . . .	55	195	125	1	3.6	2.3
<i>Poplar, 0.48-0.50 m. in diameter</i>						
standing . . . . .	22	50	30	1	2.3	1.4
logs (unbarked) . . . . .	30	85	60	1	2.8	2
sawn . . . . .	42	123	95	1	3	2.3

Regarding cost of working, labour and transport, the author observes that their increase seems to account for the differences between the coefficients of the prices charged by the producer and the wholesale merchant, whether trader or sawyer, but not by the retailers. He gives the costs in connection with oaks of medium size, but only for sawn wood at the sawyer's timber-yard, in the country, free of town-dues, taking profits and general expenses on the supposition that the felling-ground is 5 km. from the station and including unloading, also that the buyer's saw mills are near a station not more than 60 km. from where the logs are put on rail, these logs to have a circumference of 1.20 m. to 2 m. at the root and the figures to include costs of working, transport and sawing into lengths.

The following are the prices paid to producer and charged to consumer for *firewood*:

	Coefficient of Increase
In 1914 for the "stere" (1 cub. m.) with all kinds mixed, the average price paid to the grower (prices vary considerably according to locality) was 5 fr.	1
In 1919-20, before the economic crisis it was under the same conditions, 12 frs.	2.4
In 1922, either there were no buyers or it averaged with very considerable variations 5 fr.	1
In the country delivered, to consumer, including town-dues 1 fr. in a small town situated 30 km. from the forest ground the "cord" cut and shaped was quoted by the timber merchant to the customer in 1914 at 14 fr.	1
In 1919-20 it fetched, under the same conditions, 40 fr.	2.8
In 1922 it fetched 30 fr.	2.1



	1914	1920 and 1921	Increase	Coeffi- cient	1922 Feb- ruary	Coeffi- cient of increase
	fr	fr	fr		fr	
Felling of 1,400 cub. m. rough to obtain 1 cub. m. dressed . . . . .	1.40	5.25	3.85		5.25	
Cartage (by road) of 1,400 cub. m. to the rail- way station (5 km.) . . . . .	8.40	35.00	26.60		35.00	
Loading cub. m. 1,400 at the station (on rail- way trucks) . . . . .	0.90	3.00	2.10		3.00	
Transport by rail of 1,400 cub. m. to the saw mill supposed near a station 60 km. from the first. . . . .	6.75	19.50	12.75		19.50	
Storage in the timber-yard . . . . .	1.00	3.00	2.00		3.00	
Sawing into lengths, per cub. m. of trim- med length (1,400 cub. m. rough) . . . .	20.00	50.00	30.00		50.00	
Total No. 1 . . . . .	38.45	115.75	77.30	3	115.75	3
Merchant's profit and general expenses together estimated as 20 % of the gross selling price of 1,400 cub. m. rough sold retail trimmed (130 fr. in 1914—400 fr. in 1920 — 300 fr. in 1922) . . . . .	26.00	80.00	54.00		60.00	
Total No. 2 . . . . .	64.45	195.75	131.30	3	175.75	2.7
For the Paris market, at a supposed distance of 150 km. from the former, the following must be added :						
Transport to station and loading on truck . .	2.50	9.00	6.50		9.00	
Transport from departure station to Paris, 150 km . . . . .	9.50	29.70	20.20		29.70	
Cartage on arrival . . . . .	10.00	30.00	20.00		30.00	
Excess of merchant's profit and general expenses in proportion to change in selling price :						
20 % on { in 1914 : 160 — 130 = 30 fr. {						
{ in 1920 : 600 — 400 = 200 fr. {	6.00	40.00	34.00		30.00	
{ in 1922 : 400 — 300 = 100 fr. {						
Paris town dues, unchanged (11 fr. 28 c.) . .	—	—	—		—	
Total No. 3 . . . . .	92.45	304.45	212.00	3.3	274.45	3

In Paris, the price paid to the wholesale merchant for 1000 kg. (the "stere" = 450 kg.), double sawn, delivered to the house in lots of 500 kg. and upwards, and including town dues but not "pour-boire" was :

	per 1000 kg	per . . .	Coefficients
In 1914 . . . . .	60 fr.	27 fr.	1
In 1919-20 (from 180 to 200) . . . . .	190 "	86 "	3.2
In 1922 . . . . .	150 "	68 "	2.5

The comparative cost of working, transport and delivery to domicile of 1 "stere" of dressed firewood in 1914, 1920 and 1922, in a forest with a railway station situated 30 km from a small country-town, where the dues are 1 fr per «stere» is as follows

Items of Cost	1914	1920	1922
	fr	fr	February
Felling, shaping and stacking	1.50	6.00	5.50
Cartage to station 5 to 6 km	1.50	6.00	5.50
Loading on truck	0.25	1.00	1.00
Transport by rail, 30 km	1.05	2.80	2.80
Carting from Station to timber yard	0.50	1.50	1.25
Stacking in timber yard	0.30	1.00	0.80
Delivery to customer	1.00	4.00	3.50
Town dues	1.00	1.00	1.00
Total	7.10	23.30	21.35
Price paid to grower for standing timber	5.00	12.00	5.00
Total cost price	12.10	35.30	26.35
The timber merchant sells at	14.00	40.00	30.00
Profit per 'stere' after deducting all general expenses and taxes, including that on turnover	1.90	4.26	3.32
If it be reckoned that this profit should have been at least 20 %, these last figures should be increased by	2.80	8.00	6.00

The following are the items of cost to be taken into consideration in fixing the retail price of charcoal per sack of 30 to 40 kg in a small town situated 30 km from the forest ground (table p 845)

The table gives the comparative cost of working, charring, transport and delivery (as charcoal, to domicile of 1 "stere" of fresh hard wood mixed with  $\frac{1}{3}$  or  $\frac{1}{4}$  of white wood, in a small town situated at 30 km from the forest ground, in 1914, 1920 and 1921-22, as compared with the prices of charcoal sold retail per sack of 30 to 40 kg

The bark constitutes another important product. The various items of the costs of the returns are given (table p 847)

The author sums up the present state of the timber market in France as follows

*Wood for working* whereas in 1920 when prices had reached the highest point the grower sold wood of all kinds for working at an average coefficient of 2.6, the wholesale timber-merchant sold at 3.1 and the retailer at 4.5, labour (felling, sawing and transport) cost 3, and in the forest, the woodman alone 3.7. At present the grower sells at an average coefficient of 1.6 (and for oak, which forms 70 % at least of the total, only 1.3), the

wholesale merchant at 2.4, the retailer at 3.5, labour and transport together cost 3 and the woodman alone 3 8

*Firewood* : in 1919-20 when prices were highest, the grower sold at an average coefficient of 2 4, the wholesale timber-merchant at 2 8, the retailer at 5, the woodman alone cost 3 6. At present the grower sells at 1, that is, at the 1914 price, and does not even find buyers for  $\frac{2}{5}$  of the timber felled, the wholesale timber-merchant at 2 1, the retailer at 3 and the woodman still at 3 6

	1914	1922	Coefficient of increase
	fr	fr	
The "stere" of standing white wood (350 kg) for converting into charcoal was worth net, to the grower	1	1	
100 kg of charcoal delivered to the customer in the small town fetched	14	35	2 5
As 1 "stere" of wood for charring yields 65 kg of charcoal on an average, the "stere" of fresh wood converted into charcoal costs the customer	9 15	22 75	2 5
The total cost of converting 1 "stere" of fresh wood into 65 kg of charcoal including town-dues of 1 fr per 100 kg of charcoal and tax on turnover (see details annexed) is	5 80	18.22(1)	3 1(1)
By deducting this cost from the preceding totals the timber merchant's profit on 1 "stere" of fresh standing wood by selling the charcoal is	3 35	4 53	
And as the merchant has paid the producer for 1 "stere" of standing fresh wood	1 00	1 00	
It follows that for every "stere" of fresh wood, the merchant to cover his general expenses and profit has	2 35	3 53	
and this profit and general expenses work out, on 25 %, at a percentage of	25 %	15 4 %	

(1) Including a tax of 1 1 % on 22 fr 75 = 0 fr 25 c

The grower to-day sells all standing wood for working, especially resinous wood, firewood and charcoal, at extremely low prices. The prices of manufactured wood products are still too high for the customers who use the wood at home, but the position in this department shows

Details of cost	1914	1920	1922 (Feb- ruary)
	fr.	fr.	fr.
<b>Preliminary data.</b>			
One "stere" of fresh hard wood mixed with $\frac{1}{3}$ or $\frac{1}{4}$ of white wood produces an average of 65 kg. of charcoal, which sell, per 100 kg. (= 4 hl.) at . . . . .	14.00	60.00	35.00
Hence the "stere" producing these 65 kg. is valued at . . . . .	9.15	39.00	22.75
<b>Items of cost of working per "stere" to be deducted :</b>			
Felling and shaping . . . . .	1.50	6.00	5.50
Charring . . . . .	1.25	5.00	4.50
Sacks and string per 65 kg. of charcoal . . . . .	0.50	2.00	2.00
Transport to station of 65 kg. of charcoal and loading on truck . .	0.60	1.75	1.50
Railway transport of 65 kg for 30 km . . . . .	0.20	0.52	0.52
Cartage on arrival . . . . .	0.20	0.80	0.70
Expenses of delivery retail per sack of 1 hl. 75 . . . . .	0.80	3.00	2.50
Town dues . . . . .	0.75	0.75	0.75
Total cost . . . . .	5.80	19.82	17.97
The 65 kg. or 1 "stere" net standing therefore realise . . . . .	3.85	19.80	4.78
Less tax on turnover . . . . .	—	0.45	0.25
Net proceeds . . . . .	3.35	18.73	4.53
The timber merchant having paid the producer for the "stere" . .	1.00	7.00	1.00
His profit and general expenses amount per "stere" to . . . . .	3.35	11.73	3.53
= a percentage of . . . . .	25.6	30	15.4

signs of improvement. Labour has not suffered since it averages a coefficient of 3, which corresponds to the increased cost of living. The prices at present realised by the grower are extremely low, for though the rise in price of firewood is nil, and between 40 and 50 % for wood for working as compared with 1914, this rise is of real effect when compared with a diminution of 300 % in the buying power of money and 300 % increase in the cost of living. And when the consumer at last sees this percentage of 300 % diminish, that of the producers, at present nil or almost so, far from disappearing, will, as regards hard wood for working, rise.

	1914	1922	Coefficients
	fcs	fcs	fcs
The average price of bark per 1,040 kg loaded on railway truck is	75	200 (1)	2.7
The cost of barking, properly so called, in the forests, is	35	90	2.6
To which should be added			
Carriage to station or tannery, supposed distance of 5 to 6 km	5	18	3.6
Loading on truck	0.60	2	3.3
Withies	3	8	2.7
Discount of 3 % off the selling price agreed on unless other wise stipulated	2.25	6	
Tax on business turnover		2.20	
Which brings the total expenses up to	45.85	126.20	2.8
The net proceeds after deducting these expenses from the selling price are	29.15	73.80	
The average price paid to the grower for the bark on the tree was	2.1	6.1	
Leaving the timber merchant (as profit and to cover general expenses)	6.15	13.80	
Or per cent on the total price	12	6%	

(1) According to the market price in Feb 1922.

(A B)

## LIVE STOCK AND BREEDING.

- 727 - **Supposed Poisoning of Sheep by Button Grass (*Eleusine aegyptiaca*).** — BERNY I. L. and WHITE C. F. in *Queensland Agricultural Journal* Vol XVI Pt V, ng. 1 p 17 Brisbane, 1921

HYGIENE  
OF CATTLE

Sheep belonging to BERNY, put to pasture in a meadow, 90% of which was covered with "button grass" (*Eleusine aegyptiaca*) on the following day showed serious symptoms of poisoning, which proved fatal to 2 or 3 animals. As regards the rest the symptoms disappeared during the next night.

WHITE, who made a study of specimens of the plant, has not been able to produce reactions with a withered plant, sufficient to prove definitely a glucoside with a hydrocyanic acid content, but he calls attention to the fact that "button grass" contains this glucoside in fairly large proportions during the whole year except in mid-winter and towards the spring. The case quoted is the first in which button grass has been definitely associated with stock poisoning.

E. F.

- 728 - **Poisoning of Cattle by the Prussic Acid in Sorghums.** — VINALL, H. N. (Office of Forage Crop Investigations, Bureau of Plant Industry, U. S. Dept. of Agriculture, Washington D. C.), in *Journal of the American Society of Agronomy*, Vol 13, Nos 6-7, pp 267-280 bibliography of 22 works Lancaster, Pa. and Washington D. C., Oct 15, 1921.

A study of the literature dealing with this question. Certain facts are worthy of special attention. Poisoning of cattle with green sorghum

has been known for some years: PEASE (1877) states that in India large numbers of deaths were due to this cause: the crop was "semi-parched for want of rain". Sorghum poisoning was frequent also in 1887 and 1895, both dry years, and the natives accounted for it by the attack of a small insect, known as "bhaunri" which is prevalent in dry seasons and poisons the sorghum. Other theories include the belief that the sorghum leaves collected in the paunch and gave off gases, causing death by asphyxiation. PEASE decided on investigation that death was due to nitrate of potash which occurs in abundance in stems of withered sorghum plants, especially at the nodes. The symptoms of poisoning from nitrate of potash are somewhat similar to the symptoms of prussic acid poisoning. This theory was disproved later or at any rate, it was found that nitrate of potash was not invariably the cause of sorghum poisoning.

At the Nebraska Station (U. S. A.) in 1900, HILTNER found no substance in the plant which had caused death. In 1901 SLADE, assistant chemist at the same Station, suggested that the damage was due to prussic acid. The year following, the two English investigators, DUNSTAN and HENRY reported for the first time this discovery in a paper received by the Royal Society of London on April 24, read May 15 and published in the "Chemical News of London," June 27, 1902. Independently, SLADE also isolated prussic acid from a sample of fresh sorghum, about August 1, 1902. His report was sent to the Journal of the American Chemical Society for publication October 3, 1902. AVERY continued the work of SLADE and, in collaboration with him and PETERS, a careful summary of results was published in 1903, which leaves little room for doubt that prussic acid was the direct cause of sorghum poisoning. CRAWFORD found for the first time in 1906 that prussic acid exists also in Johnson grass (*Holcus halepensis* L.) and FRANCIS traced the acid in Sudan grass (*Sorghum exiguum*) in 1915.

According to DUNSTAN and HENRY the prussic acid does not exist in this form in sorghum, but under certain conditions is liberated from cyanogenetic glucoside, known as "dhurrin". Decomposition is effected by hydrolysis, by an enzyme emulsin, which may result under certain conditions in the liberation of the poisonous acid; dilute hydrochloric acid may have a similar effect. An empirical formula is given for the glucoside and the resulting decomposition is explained. SLADE and AVERY arrived at practically the same conclusions. WILLIAMSON (1917) claims that prussic acid is found in sorghum in both a glucoside and non-glucoside form. The work of RAVENNA and BOBINI (1912) agrees with this; they claim to have found free prussic acid in sorghum leaves as well as in the leaves of peach, cherry, laurel and flax. It is satisfactory to note, however, that these Italian investigators themselves modify their results somewhat by acknowledging the facility of producing free prussic acid by autolysis during the experiment.

According to data carefully selected and compared, it appears that Sudan grass is less poisonous than common sorghum. An average of 18.9 lb. is necessary to poison cattle and with common sorghum, only 7.6 lb. is required.

The leaves contain the larger proportion of poison, and the fact that animals prefer the leaves, explains why small quantities are sometimes sufficient to prove fatal; in one case there was poisoning with only 8 lb. of Sudan grass leaves.

Sorghum and Sudan grass cured as forage are usually harmless. Two theories are put forward: according to AVERY the enzyme remains inactive, but DOWELL claims that when the plant is dried, the acid is volatilised. Verification of this theory is still necessary and will have a practical application in determining the most desirable methods of curing the plant.

Adverse climatic conditions, such as drought and frost favour the formation of prussic acid. This has been proved by several experiments and the average analysis shows that there is more than twice the amount of prussic acid in injured plants than in normal. In one case only the normal plant was richer in acid than the plant which had suffered from frost. In accepting this conclusion, it is necessary to distinguish between plants stunted by drought, frost, arid soil, etc. These all showed a low prussic acid content, especially if the poor soil lacked nitrates.

The percentage of acid decreases with the age of the plant. Cold climates are more favourable to acid production and this point is discussed at length. Varietal differences also have a marked influence on the acid percentage.

The poisoning (of which the symptoms are described) is so quickly fatal that treatment is difficult. Glucose, dextrose and other forms of sugar are known as antidotes. As these are formed from amides during digestion, a possible explanation is given of the fact that animals fed on maize can afterwards feed on large quantities of sorghum with impunity. Other remedies are discussed: salt purgatives, peroxide of hydrogen, etc. Their immediate application is necessary.

L. V.

729 - **Control of Tuberculosis in California.** — See No. 679 of this Review

730 - **Warts on Horses and Cattle.** — WILLIAMSON H., in *The Pastoral Review*, Vol XXXI, No. 8, p. 620, Sydney and Melbourne, Aug. 1922

Little is known as to the nature and origin of these warts and consequently the treatment can only be based on observation. The author divides them roughly according to form and the best method of treatment:

a) pedunculated, or narrow-necked, a ligature may be used with or without caustic agent to hinder the blood circulation in the wart; the action may be hastened by a previous dressing of chloride of zinc or of corrosive sublimate;

b) encysted warts; open the cyst with a knife and permit the escape of the pus.

c) broad based warts; treat with washing soda or soap powder to soften the surface and then with a caustic agent to penetrate into the wart. A very efficient but not the safest paste is one composed of arsenic and soft soap. Warts which develop on delicate parts of the body (eyelids etc.) should be treated with a solution of collodion 7 parts to salicylic acid 1 part.

E. F.

731 - Investigations on Infectious Abortion in Cattle and Swine in the United States, —

I STAFSETH, H J and HUDDLESON, J F Studies in Infectious Abortion, *Michigan Agricultural College Experiment Station, Technical Bulletin* No 49, 30 pp, Lansing, Mich Nov 1920 — II HALLMAN, E T, Infectious Abortion in Cattle, *Michigan Agricultural College Experiment Station, The Quarterly Bulletin*, Vol III, No 3, pp 81, East Lansing, Mich, Feb 1921 — III CONNAWAY, J W DURANT, A J, and NEWMAN H G, Infectious Abortion of Cattle *University of Missouri, College of Agriculture, Agricultural Experiment Station, Bulletin* 189 pp 57-58, Columbia, Miss, 1921 — IV SCHROEDER, F C, Bureau of Animal Industry, Investigations on Bovine Infectious Abortion, *Journal of the American Veterinary Medical Association*, Vol LX, No 5, pp 542-561, Washington, Feb 1922 — V CONNAWAY J W, and DURANT, A J, and NEWMAN H G, Infectious Abortion in Swine, *University of Missouri, College of Agriculture Agricultural Experiment Station, Bulletin* No 157, 28 pp, figs 12 bibliography of 16 publications Columbia Miss, 1921 — VI HUDDLESON, J The Susceptibility of Swine to Contagious Abortion (*Bacterium abortus* Bang) *Michigan Agricultural College Experiment Station The Quarterly Bulletin*, Vol 4, No 2 pp 43-45 East Lansing Mich Nov 1921

I This work is divided into 4 parts (of which the first 3 are written by Dr H J STAFSETH)

1st Part — ON THE PRESENCE OF THE *Bact abortus* IN THE INNER LAYERS OF THE MEMBRANE OF THE UTERUS OF A FEMALE NOT IN GESTATION (pp 3-6)

The present state of our knowledge on the etiology of infectious abortion leads us to conclude that *B abortus* attacks the uterus only during gestation and disappears rapidly after abortion or normal delivery. It must be admitted then that *B abortus* does not remain permanently in the uterine cavity. On the other hand it is known that certain pathogenic agents may exist in the under layers of the skin and the intestinal mucus without causing trouble although the tissues attacked are generally subject to the characteristic infection of these micro-organisms. The author therefore wished to ascertain whether *B abortus* could penetrate to the deep layers of the uterine mucus and remain there in a state of latent infection.

With this object, he made a bacteriological examination of the uterus of 6 cows which had aborted and were seriously infected. He found a slight bacterial flora (*Staphylococcus pyogenes aureus et albus*, *Streptococcus* sp, *Micrococcus* sp, *B subtilis*, *B coli communis* and *Trichobacterium* sp) in the mucus of the uterus but in no case was there any *B abortus*. This investigation does not definitely solve the problem on account of the small number of animals examined.

2nd Part — NOTES ON THE ISOLATION AND CULTURE OF *B abortus* BY USING LIVER AND SPLEEN SECRETION AS A CULTURE MEDIUM (pp 7 to 11)

*B abortus* is generally associated with other micro-organisms which multiply much more rapidly in artificial mediums than the first named, and impede its development. It is therefore difficult to obtain a pure culture. The author was able to isolate certain species of *B abortus* fairly easily by using culture mediums to which he added hepatic or splenic secretion.

Development was accelerated by the addition of small quantities of starch and dextrose.



3rd Part. — ON THE POSSIBILITY OF DISTINGUISHING INFECTED ANIMALS FROM HEALTHY ONES (4 tables) (pp. 12-24).

It is known that cattle may be infected with *B. abortus* without immediately showing signs of the disease and that so far no characteristic and specific biological reaction is known by means of which infected animals may be detected. The author, using the works of other writers (1) tried two "abortines": alcoholic ether extract of *B. abortus* and a bacillary solution; the latter gave good results. The subcutaneous reaction is obtained by injecting this solution in the abdomen of a guinea pig and shows itself locally under the form of a hardening and reddening of the part, which mortifies after 2 or 3 days. This reaction is specific. The author also observed that:

a) the guinea-pigs in which dead *B. abortus* cultures have been injected do not react against them; b) the dead culture treatment, before or after infection, has no influence on subcutaneous reaction; c) the dead culture treatment does not render the guinea-pigs immune against the *B. abortus* infection,

4th Part. — ISOLATION OF *B. abortus* IN MILK (pp. 25-30).

To prevent or cure infectious abortion, it is often necessary to ascertain whether *B. abortus* exists in the milk of the apparently healthy cow. The isolation methods are attended with more or less serious difficulties, for which reason the author describes another with which he obtained good results. He employed agar-agar with a hepatic or splenic infusion as a medium. He was able to prove that: a) the development of the *B. abortus* culture depends essentially on the concentration of the hydrogenions in the medium; b) the medium containing the culture should be placed in a closed vessel in which 10 % of the air has been replaced by CO<sub>2</sub> gas; c) other micro-organisms which may exist in the milk should be prevented from interfering with the development of *B. abortus*; to effect this, a saturated aqueous solution of gentian violet should be added to the medium in sufficient quantity to ensure a 1/10000 dilution of the final solution; this substance has a selective action on the bacteria.

The method described gives the same results as those obtained by the known methods and has the advantage of being simpler, more economical and rapid.

II. THE BULL AS A FACTOR IN THE TRANSMISSION OF THE DISEASE. —

Recent researches tend to show that the importance of the bull as a vehicle for the germs of infectious abortion is not so great as was believed and that abortion may be checked to a great extent by separating the females which are not in gestation from the places and animals infected. In the present state of our knowledge, it seems evident that the infection of females takes place more often after conception and that any measures taken after impregnation to check infection reduce cases of abortion in a herd.

In practice the following advice may be given: a) the isolation of infected cows and their frequent disinfection;

(1) FLEISCHNER E. C. and MAYER, K. F. The bearing of cutaneous hypersensitiveness on the pathogenicity of *B. abortus bovinus*. *Amer. Journal Hyg.* vol. 16 No. 4. (Authors note).

b) the greatest care should be observed by the owner of uncontaminated herds in burying cows, as infection is most frequently introduced by an infected female.

III. INFECTIOUS ABORTION OF CATTLE. — Experiments to determine the effect of a more or less prolonged suspension of reproduction on the persistence of *B. abortus* Bang in infected cows. These experiments have proved that the cows cannot destroy and eliminate the disease germs. Further, infected calves no longer react against them unless they are reinfected. Cows not used for breeding do not become reinfected by continuous exposure to infection through contact with cows which react and are not in calf.

The bacteriological examination of the glands of a castrated ox, a cow and a bull artificially infected has shown apparently that the castrated ox was less capable of eliminating and destroying the disease germs than the bull, but that neither are so favourable to its reception as the cow. In the latter, the genital organs are more subject to functional trouble after infection, while the udders and teats present conditions which are favourable to the existence of the *B. abortus*.

For the suppression and prevention of infectious abortion in the herd, the authors advise the application of the serological test to all the animals in order to find out which of them show a positive reaction, to fatten and sell for killing those among the latter which are not of special value as breeders; to isolate promptly all the cows which show a tendency to premature calving; to separate from the herd those animals which react at the moment of calving; to destroy all still-born calves and cauls by burning or burying deep in the ground, to disinfect stables and litters; and to spray with antiseptics all cows which have just calved.

IV. INVESTIGATIONS ON BOVINE INFECTIOUS ABORTION MADE BY THE BUREAU OF ANIMAL INDUSTRY OF THE UNITED STATES DEPARTMENT OF AGRICULTURE. — Report submitted at the XXV<sup>th</sup> meeting of the U. S. Livestock Sanitary Association held at Chicago at the end of November, 1921. The author describes briefly the principal facts connected with the symptomatology, etiology and therapeutics of infectious abortion which have been confirmed and studied by the members of the Bureau which is under his direction. Many of these works have been published, but we will confine ourselves to calling attention to the present one.

V. INFECTIOUS ABORTION IN SWINE. — The investigations which have been carried on for some years in the Experimental Stations of the Missouri, have brought to light the following facts. The specific cause in the majority of cases of abortion in sows is a micro-organism very similar to, if not identical with *B. abortus* Bang; the identity of these two micro-organisms has been proved by a series of fixing tests for the complement and for agglutination, for the isolation and identification of the specific micro-organism, for the production of the specific reaction against abortion in sow's blood after an inoculation of *B. abortus* from a cow; and by observing the quasi-abortion of cows and sows feeding together on the same pasture.

The transmission of the disease is especially caused, it seems, by the

ingestion of contaminated substance (foetus, cauls, milk etc. The contamination of one sow by another through the agency of the boar is probable but not certain. Young pigs are also liable to infection, as also boars, and females not in pig. In the case of the young animals the reaction of the blood generally becomes negative after a few weeks, whereas with adult sows infection continues a certain time, and may even become permanent, though sows which have aborted and continue to react positively may give birth to live young. Nevertheless some become temporarily or permanently barren. Some give birth in one litter to an equal number of dead foetus and of live and healthy young. Healthy offspring may be obtained from a sow and boar both infected, by isolating the young as soon as they are born to prevent reinfection.

As preventive and curative measures, those used against infectious abortion in cows are advised; subject parents and recently born young to a serological test, isolate sows which have aborted immediately, carefully disinfect the young and destroy dead foetus and cauls.

Animals which react positively should be fattened and sold for killing if not specially valuable as breeders. In the case of a good sow, it is better to keep her for breeding, isolating the young at birth.

Vaccination is of doubtful efficacy and may perhaps infect the animals treated with permanent traces of disease germs.

Rules are given as to the method and interpretation of serological tests for the discovery of infected animals, for the treatment of the diseased sow and for boars and animals belonging to an infected herd which shows a negative reaction.

VI. IS THE PIG SUSCEPTIBLE TO INFECTIOUS ABORTION? — Some cases of abortion reported at Michigan have induced the author to undertake a bacteriological study of the disease: he concludes that pigs show great immunity against *B. abortus* Bang. Young sows eight weeks old reared on cow's milk naturally infected and afterwards contaminated by a culture of cow's and sow's *B. abortus* gave birth to young, all living except one and afterwards showed a negative reaction.

Young sows brought up on the milk of an infected cow and living in a meadow with cows, became pregnant normally when adult and gave birth to young all living and healthy. Two of these sows had been vaccinated several times. After the test, all the sows and their young showed a negative reaction.

F. F.

732 — **Investigations on the Use of Vaccines prepared with *Bacillus ovisepticus*.** — NEWSOM, I. E., and FLOYD CROSS in *Journal of the American Veterinary Medical Association*, Vol. LX, No. 5, pp. 562-579, tables 10, Washington, Feb. 1922

Recent investigations have rendered doubtful the efficacy of vaccines at present employed in the control of haemorrhagic septicemia, and even the possibility of the preparation by means of methods so far known, of really effective vaccines. The authors present verified data, with reference to this question and as a result of experiments made with *Bac. ovisepticus* which should facilitate the solution of this much discussed problem.

Successful results have been obtained with (doses varied according to circumstances): a) vaccines, for general commercial use; b) a vaccine prepared specially; bacillus grown culture prepared in boiling media for 48 hours and at 60° C for ½ hour, followed by the addition of phenol at ½ %; c) similar vaccines, but prepared according to a modified method (simple addition of phenol and no heating); d) cultures of the living organism.

Experiments have been made with rabbits, and also more particularly with sheep. The vaccines in which the bacillus have been destroyed by heating gave little or no immunity. Sterilisation with phenol renders the vaccine even less effective. Cultures of living bacilli have been tested only with sheep. The minimum fatal dose has varied with breed, but usually it is fairly high if inoculation is sub-cutaneous. The authors consider therefore that the use of living *Bac. o. septicus* as vaccine is not dangerous if the doses are limited to those generally employed in laboratories (1).

In view of our present knowledge, the use of the living organism as a vaccine is advised in preference to that of bacilli destroyed by heat or antiseptics.

E. F.

733 - Diseases in Domestic Birds transmissible to Man. — MURELIO, M., in *Bassa Corte*, V III, fasc. 52-53, pp 1010-1020 Molassana (Genoa), April-May 1922

Among the various diseases, common to man and to birds which the author calls "anthropornithologic", he mentions "psittacosis", Maltese fever and the sleeping sickness.

The first, of bacillary origin, is incurable and contagious both to parrots and to man by direct contact. The author recalls an epidemic which broke out in Genoa in 1891, and which was fortunately localised in a block of houses, though not before several human beings had fallen victims.

He proposes therefore to place parrots coming from America under observation for a period of at least 20 days.

Maltese fever (caused by the *Micrococcus melitensis*) attacks chickens in two forms: the acute form lasting 8 to 10 hours and the form which causes death after a longer period. The author recalls an epidemic which broke out in 1911 among chickens in the neighbourhood of Nîmes, which proved mortal in 70 % of the cases. It was studied by M. DUBOIS.

From observations made by the author in Liguria, there is some connection between the "sleeping sickness" of chickens, which succumb immediately or almost so, and lethargic encephalitis in man. The infection is of short duration, and is caused by the *Streptococcus capsulatus gallinarum*.

F. D.

(1) It is interesting to note that MEISNER and SCHERN (*Arch. f. Tierheilk*, Vol. 36, p. 208) have succeeded in isolating a bacillus so virulent that it is fatal even when given in small quantities (*Author's note*)

734 - **Spirochetosis in Rabbits.** — RUPPERT, F. (Mitglied des Staatsinstituts für experim. Therapie), in *Berliner tierärztliche Wochenschrift*, XXXVII year, No. 42, pp. 493-496, 4 fig., bibliography of 18 works Berlin, 20th Oct. 1921.

Rabbit spirochetosis is the name given by the author to a contagious sexual disease caused by the *Spirochaeta cuniculi* (1) and already described under various names by different authors. Spontaneous outbreaks have been reported in England, Holland, Germany and France. It is transmitted from one individual to another during sexual intercourse. This has been proved from experiments made by the author, as also the fact that infection shows itself after a 2 to 4 months' period of incubation, during which the spirochetes live on the genital parts and are a constant source of infection to all animals having sexual relations with the animal infected. By placing the spirochetes in contact with the skin of the genital parts, the disease is easily transmitted from one individual to another; in this case, incubation lasts 20 to 72 days. No one has yet succeeded in transmitting it to white rats and guinea-pigs. The symptoms may be classed in two series corresponding to the two successive stages of the disease: in the first period (about 3 weeks after the artificial infection) the genital parts become inflamed and a watery fluid collects between the prepuce and the penis, spirochetes are sometimes, but not always, found in this fluid. After 2 to 3 weeks the secretion becomes purulent and small abscesses of the size of a millet seed form on the prepuce (or on the edges of the vagina). The vagina and prepuce become red and increase to 3 or 4 times their normal size. Subsequently the abscesses dry up and form small scabs, which are easily detachable. Spirochetes are always found on the injured parts and their number increases considerably during the course of the disease. In the second period the diffusion of the virus takes place: abscesses of the size of a lentil form, mostly around the anus, rarely on the muzzle. Sometimes small abscesses are seen which may unite, and form one only. By pressing the injured parts a watery fluid containing a large number of spirochetes is expelled.

The prognosis is as yet uncertain; animals infected may survive a year or even 18 months and have healthy offspring; on the other hand they may succumb to secondary bacterial infections which penetrate through the lesions to the organs of the body. An anatomopathological examination reveals all the characteristics of acute inflammation of the genital organs; the diagnosis is based on microscopic examination. The differential diagnosis between the experimental syphilis of rabbits and spontaneous spirochetosis is very difficult for these two micro-organisms show no morphological differences nor differing reactions under the staining media usually employed; while (2) the lesions produced in either case are so different that it may be considered that there are two distinct morphological species. For instance, in spontaneous rabbit spirochetosis, the hardening which is typical

(1) This disease is therefore distinct from rabbit syphilis produced by the experimental inoculation of *Sp. pallida* (Author's Note)

(2) According to research by KOLLE and MORBUS (1919-21, quoted by the author. (Ed.)

of human syphilis inoculated into rabbits is never met with, also *Sp. cuniculi* always settles just under the skin whereas *Sp. pallida* penetrates deeply into the tissues.

Arsenobenzoline products exert a specific therapeutical action : 0.04 gm. to 0.06 gm. of salvarsan of sodium and of silver per kg weight always cures. The infection may be contracted more than once, so that there is no immunity.

E. F.

- 735 - Effectiveness of Tetrachloride of Carbon against *Uncinariae* (*Nematoda Strongylidae*) in Dogs. — ALLEN, I. A. (Animal Pathologist in Charge, Fox Research Station, Health of Animals branch, Canada), in *Journal of the American Veterinary Medical Association*, V LXI, No 1, pp 31-37 Washington, April 1922.

The author has used tetrachloride of carbon as a vermifuge (especially against *Uncinaria stenocephala*, but also against ascarides) in 399 cases, and has observed that it is more effective and less dangerous than chloroform and thymol.

It should be administered after a fast of 12 to 14 hours in the form of gelatine capsules, the dose should be 0.3 gm. per kilogram of weight. Afterwards it is well to administer a little castor oil to facilitate deglutition. With adults it is often necessary to overcome the resistance of the animal against swallowing the capsule — it sometimes happens in such cases that the capsule breaks and that artificial respiration must be resorted to.

E. F.

#### FEEDS AND FEEDING

- 736 - Feeding and Contact Experiments with St. John's Wort (*Hypericum perforatum*) in New South Wales. — HENRY, M. (Government Veterinary Surgeon), in *Agricultural Gazette of New South Wales*, Vol XXXIII, Pt 3, pp 205-207 Sydney, March, 1922

Results of previous feeding experiments with St. John's Wort (*Hypericum perforatum*), indicated that the plant rendered the skin peculiarly susceptible to the action of the sun's rays, and that the animal suffered considerably in consequence. Further experiments have been made to test the effect of feeding the plant at a less-developed stage and also the effect of continued contact of the plant with the skin. Cattle and sheep were placed in a field almost entirely overgrown with *H. perforatum*.

In both cases the effects of internal irritation were evident, especially in the full heat of the day, and the abrasions were noticeable.

In the contact experiments, the animals were muzzled before being allowed to run in the paddock. No signs of ill-health or external skin irritation were observed, even when the plant was in full flower and there was much pollen.

The animals which had suffered as a result of feeding on this plant, recovered their equilibrium after removal from the field, and the abrasions were replaced by clean, healthy tissue.

M. L. Y.

737 - **The Mannitol-Producing Organisms in Silage.** — PLAISANCE, G. P., and HAMMER, B. W. (Bacteriological and Dairy Sections of the Iowa Agricultural Experiment Station), in *Journal of Bacteriology*, Vol. 6, No. 5, pp. 431-433, bibliography of 7 works. Baltimore, Sept. 1921.

The chemistry section of the Iowa Agricultural Experiment Station has shown (DOX and PLAISANCE, 1919), that mannitol is a normal constituent of silage and that it is formed by bacterial reduction of the fructose of the sucrose molecule. In silage fermentation the mannite is produced in considerable quantities, simultaneously with the acids, the alcohol, and the carbon dioxide, and its presence accounts in a large measure for the deficit noted when the sum of these products is supplemented by fermented sugar. Mannitol has also been found in various fermented materials such as wine, vinegar and sauerkraut, etc. as well as its production by organisms.

The aim of the present experiments was to isolate from silage, organisms capable of producing mannitol, either when grown in pure cultures in maize and maize juice, or by adding agar, peptone and sucrose, or by using chopped green maize adding about 5 % sucrose.

Mannitol determinations were made by extraction with boiling 95 % alcohol and after leaving to cool and crystallise, were then weighed.

If ether, chlorophorm, formaldehyde, or toluol were employed for sterilisation, no trace of mannitol was found ; the organisms are therefore indispensable

The organisms capable of producing mannitol were isolated from fresh silage ; small colonies were obtained on agar, and probably form part of a group of lactic bacteria ; the reducing element is evident in the pronounced change in colour in the fermenting juice. These organisms are well distributed and have been observed in the soil from a farmyard and also in milk. Undoubtedly many other organisms are associated with mannitol production but not so generally characteristic and invariably recognisable.

Mannitol has also been produced by organisms isolated in the sunflower, sugar cane, dandelion silage and in cabbage juice, but not in that of carrots, beets or apples.

The addition of fructose considerably increased the production (3.71 %) due to the direct transformation of fructose to mannitol. The addition of sucrose or inulin was less effective owing to indirect transformation. Results varied with the determinations made ; thus in one case, the sugar cane juice with 2 % sucrose gave 0.49 % mannitol, and in other cases 1.85 %. The carbohydrates, apart from those mentioned, gave entirely negative results.

When flooded with oil, which assists anaerobiosis, and consequently aids the reduction responsible for mannitol production, a much greater quantity is obtained, probably because the development of reducing agents encourages anaerobiosis, and this method is rendered superfluous.

The quantity of mannitol increases during ensilage, up to a certain limit ; reduction then follows, evidently due to repeated partial destruction, caused by the same organisms. This has been demonstrated in pure cultures obtained by experiment.

L. V.

[137]

- 738 - **Malted-Grain Sickness of Cattle considered as one of the illnesses due to Malnutrition.** — POENARU, J. (Clinical Hospital of the Faculty of Veterinary Surgery, Bucarest) ("Clinique médicale de la faculté de Médecine Vétérinaire, B.") in *Comptes rendus des Seances de la Société de Biologie*, Vol LXXXVI, No. 11, pp 640-641. Paris, 18th Mar. 1922.

Six hundred oxen, fed exclusively on malted grain, soon showed symptoms of malt sickness: loss of appetite, diarrhea, difficulty in standing up, increasing weakness, and 12 oxen died in a state of extreme exhaustion. But as soon as this feed was mixed with others, such as: chopped straw, hay and a little bran, the morbid symptoms disappeared. The author subjected malt sickness to experimental investigation and observed that it may be included in the group of illnesses due to malnutrition, and that the indispensable elements lacking in malted grain, which is sterilised by the distillation temperature, contain the essential vitamins; if the latter are supplied by the addition of other food products, the sickness is averted.

F. D.

**STOCK  
BREEDING**

- 739 - **The Application to Stock-Breeding of Some new Views concerning Heredity.** — DECHAMBRE, P., in *Comptes Rendus de l'Académie d'Agriculture de France*, Vol VIII, No. 11, pp. 359-365. Paris, March 1922

The progress of stock-breeding is intimately connected with the possibility of fixing by heredity the variations, or characters, that will improve the quality of animals. Hence the attempt to apply to stockbreeding the knowledge obtained from the researches on heredity that have been carried on for several years in the scientific world

From among the new facts concerning heredity that are of almost direct application to stock-breeding, the author singles out for special mention those bearing on the dominance of certain characters.

Generally speaking, albinism in all species is recessive. Thus, the products of a cross between breeds with pigmented mucous membranes and those with non-pigmented mucous membranes have coloured mucous membranes. Of this there are several instances in cattle; the hybrids of Charolais × Schwitz in the district of Aube and Côte-d'Or are white like the Charolais breed, but have a black muzzle, the hybrids of Charolais × Vendée breed are large animals with light coats, but black mucous membranes and legs; the hybrids of Limousin × the Brown Cevennes breed have the good conformation of the Limousin parent but black coat and legs.

Southdown rams, when crossed with white ewes, produce lambs with greyish faces and legs.

As dominant characters the author mentions the tuft of the Paduan fowl and the long hair of the guinea-pig. In horses, black and bay coats are dominant as regards chestnut, and grey and roan as regards bay.

In cattle, hornlessness is dominant as regards the possession of normal horns. When a polled bull is crossed with a normally horned cow, polled offspring are obtained. This was discovered in England a long time ago by crossing the Angus and Shorthorn breeds. The Sarlabot breed originated from a similar cross between the Normandy and the Angus and Red Polled



breeds. This cross was effected in 1852, and the polled character of the progeny was immediately fixed. For the last fifteen years, the author has used the Sarlabot breed in his crossing experiments at Grignon, where its essential character, absence of horns, proved itself to be dominant.

Early maturity, and high milk yield are some of the dominant physiological characters.

Dominance does not, however, always manifest itself even when the contrasting characters are well-marked. Piebald lambs with large black and white patches and "half-tail" resulted from the crossing at Grignon of a Berrichon ram with slender tail, and Somali ewes with thick tail, white body, and black head and upper portion of the neck.

Some colours are sex-linked, thus if a silver Hamburg hen is crossed with a golden Hamburg cock all the hen chicks are golden and all the cockerels silver.

Although the products of the first cross are generally very much alike owing to the presence in the parents of dominant and recessive characters, all homogeneity is lost when the hybrids are mated up together and the recessive characters again make their appearance.

This was discovered some time ago by the Marquis of Béhague in the case of Southdown  $\times$  Berrichon lambs, and it is therefore not advisable to mate hybrids together, but to obtain them direct by the crossing of pure-bred parents. This is very commonly done amongst sheep-breeders supplying the meat market, and is now gaining ground among cattle-breeders, pig-breeders and even poultry rearers in the case of produce destined for the table. The author maintains that equally good results could be obtained by extending the same practice to horses.

"As soon as experimental research work has been continued sufficiently long for it to be possible to determine the reciprocal relations of the dominance and recessiveness of many characters, the breeder will be able to know beforehand the characters that will reappear in the hybrids and thus be in a position to obtain, at least to some extent, animals suited to satisfy the needs of the moment, or the requirements of any particular market."

For this reason, the author is of opinion that "one of the great objects of the Stock-Breeding Research Laboratories should be the study of new methods of propagation based on scientifically conducted experiments, and applicable to practical stock-raising. These methods could either be applied directly, or after they have proved effective by testing them at special Institutes under the direction of the Agricultural authorities, and at Stock-Breeding centres."

F. D.

740 - **Livestock in Eritrea.** — TARANTINO, G. B. (Osservatorio zootecnico, Asmara) in *Allienamenti*, Yr. II, No. 12, pp. 401-403, Palermo, Dec. 1921; Yr. III, Nos. 1-2, pp. 17-19, Jan.-Feb. 1922.

**STOCK RAISING**

In Eritrea, every native is in possession of a certain number of cattle and sheep. The census for 1905 and for 1920-1921 indicate respectively: horses 20 130 and 35 111, cattle 248 051 and 498 412; sheep and goats

679 457 and 1 531 149 ; camels 28 922 and 23 312. Except for the camels, which have slightly decreased in number, the total has shown an increase. It is observed that these data are certainly below the average, owing to the reserve of the native who objects to giving information concerning his stock, for fear of taxation, consequently a 10 % increase may be estimated

The actual condition of the stock has remained stationary ever since before the Italian occupation, the native is not interested in improvement, as the selling of stock is not his object he prefers rather to utilise the products himself. Near Asmara, where most of the Italian colonies are situated, a few half-breeds between the local cattle and Swiss breeds are seen, but these possess no special qualities

The trade in livestock and its products is very limited, slaughtering takes place on solemn occasions apart from this they are used in the fields, thrashing wheat etc as beasts of burden. As regards products these comprise butter, and skins for tanning purposes for local requirements

The chief cattle breeds are the Arado, found on the Upper plateau (Hamasiën, Seræ Accheli Guzai-Gasc-Settit) and Begait found on the western plateau (Barca and Gasc Setit) both breeds are seen in the Cheren province. The original Arab cattle are found on the coast, chiefly at Massowa

The Eritrean cattle like the Abyssinian breed are zebus. The Arado breed is characterised by its strength and adaptability to farm work and is easily managed. The Begait (dolichomorphous often without horns generally a white skin sometimes spotted) is on the contrary very timorous and difficult to approach

The Eritrean horses belong to the Galla, Dongola and Abyssinian breeds. On the Eastern plateau (Agordat Barenton) Dongolao stock raising is practised to a small extent (1) and native horses in Imbert (Asmaia). A Government stud station was established at Nacfa (Sahel) in 1918, at the present time a remount station has been installed at the Institute of serotherapy for a good Arab stallion. At one time horses were bred at Seimenzano and at Hamasiën this is no longer done because the land formerly used for grazing purposes is now utilised for cereal growing

On account of unfavourable conditions prevailing over the greater part of Eritrea such as excessive heat, pests etc, the superior imported stock have rapidly degenerated hence the reason why Syrian stallions, imported several years ago into Godofelassi (Seræ) and Agordat, have given unsatisfactory results. On the other hand, the donkey has proved resistant to these conditions. The mule breeding experiments made by the Government at Godofelassi the most fertile part on the Upper plateau have not been successful as the mares were debilitated by myriads of blood-sucking insects

(1) See R Feb 1922, No 188 (Ed)

A native breed of sheep covers the Upper plateau, medium size, tail large, wool short and chestnut colour, deficient in milk. The Maria-Mensa and the Habab tribes have raised the breed Arrit, which is hornless and abundant and deficient in milk. The breed Hamolé is raised on the Eastern plateau, a larger animal than the last named, with a long and scanty tail, without horns, white splashed wool, good milk.

True breeds are not to be found amongst the goats, they take their name from the colour of their skin which is red or black or from the tribes which raise them. As a rule, they are large, with long wool, comparatively good for milk, depending on the breed.

The author deals with steps the Government should take to encourage improvement of stock in the Colony and the export of meat  
F. D.

741 - **The Philippine Horse.** — LIZASO, J. in *The Philippine Agriculturist*, Vol. X, No. 4, pp. 135-144, bibliography of 8 works. Los Baños, Laguna, Nov. 1922.

HORSES

The latest census made in the Philippines shows 223 195 horses in 1915 and 203 430 in 1916, that is about 3 horses per 100 persons.

It appears that the Philippine horse is rather a composite animal containing characters from Chinese, Japanese, Mexican and Malaysia breeds etc. Consequently these characters are varied, according to which blood has dominated in a locality.

A study was made of 150 horses (142 males, 8 females), from Laguna.

The most common weight was from 450-500 lb, with an average of 470 lb. Very few weighed less than 400 lb or more than 500 lb.

The most common height was, from 12 to 12 ½ hands.

The ages varied chiefly from 4 to 6 years. The colour was bay of varying shades and next in order of frequency, black, roan, white, brown, grey.

In the head the most common defect was the projection of the upper jaw, the same defect with the lower jaw was less common.

As a rule the head was well cut, rather large, nose generally straight, nostrils fairly wide open, eyes large and bright, ears medium size and well carried. The neck was often large and heavy, but sometimes lacking muscle. Shoulders frequently lean but muscular, chest generally deep and broad; occasionally narrow-chested. Forelegs usually good, although scars have been observed, body fairly capacious and of good barrel, croup wide, but short and sloping, tail long and well carried, hind quarters generally deficient in muscle.

As a rule the build of the native horse is short and rather low-set, especially those of pronounced Chinese ancestry. These are of good quality and wonderful stamina and recuperative power.

The author considers that to encourage improvement young horses should not be worked too soon, at the age of 3 they may be given light work and only when 4 and not at 2 years as practised at present, should they be worked regularly. The horse should be improved by careful raising, use of harness and selection of breeding stock.  
F. D.

742 - **The Proportions of the Trotter.** — VAN MELDERT, L., in *Annales de Gembloux*, Year 25, Book 6, pp. 198-208. Brussels, June 1922.

The author uses the measurements (which he publishes in inches and in centimetres), of 4 trotting horses that have covered a mile in the United States in less than 2 minutes, as a basis for the study of these exceptional trotters and the comparison of their performance with that of 3 excellent Norman trotters. In order to reduce these measurements to the same scale, it was necessary to convert them into arbitrary figures, the height being fixed at 100. Table I gives these measurements; the 2 groups of the converted measurements are given in Table II.

TABLE I. — *Measurements in centimetres.*

	American trotters				French trotters		
	Peter Manning	Uhlan	Lee Arworthy	Arion Guy	Fuchsia	Conquerant	Normand
Height at withers	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Height of croup	99.02	99.19	100.00	98.56	—	—	—
Total back length	98.20	101.19	99.16	98.36	—	—	—
Length of head	41.27	40.50	37.50	40.81	39.12	40.80	40.00
Length of neck	49.35	52.45	48.33	44.48	51.20	48.80	52.50
Girth of thorax at withers	100.31	111.90	112.82	106.12	—	—	—
Girth of thorax at middle of back	110.90	111.65	109.16	102.55	—	—	—
From shoulder-point to ground	58.61	54.61	56.66	57.15	—	—	—
Length of fore cannon-bone	19.00	—	18.33	17.95	—	—	—
Upper circumference of fore limb	34.06	32.93	28.33	27.77	—	—	—
Circumference of fore cannon-bone	12.50	12.85	12.50	12.16	—	—	—
From knee-joint to ground	30.10	35.33	30.83	30.20	29.50	29.50	29.50
Height of point of hock	38.02	35.34	38.75	36.16	39.82	40.00	40.00
Height of stifle-joint from ground	63.37	64.26	66.65	60.04	—	—	—
From point of haunch to point of hock	63.37	64.26	61.66	60.40	63	—	—
Circumference of hind cannon-bone	13.86	14.05	14.16	—	—	—	—
From stifle-joint to point of hock	34.53	—	33.33	34.26	34.10	—	—
Width of haunches	38.02	35.34	30.80	28.97	—	—	—
Width of chest	23.36	26.34	23.33	22.44	—	—	—
When neck is 100 head is	83.6	77.2	77.5	90.1	76.2	83.6	77.7
Totals of head and neck	90.62	92.95	85.83	85.29	90.32	89.60	92.50

The data thus obtained show that :

1) The body-length of the trotter should be less than its height at the withers. This difference should not, however, exceed  $1 \frac{1}{2} \%$  of its height.

2) The length of the head and neck have no influence upon speed, but they have much to do with the appearance of the animal. In the American trotter and the French trotter (Normand) the length of the head added to that of the neck may amount to 93 % of the height.

The length of the fore-cannon bone varies greatly in different indi-

viduals, and ranges from 16.5 to 19 %. The length of the cannon-bone thus has no effect upon speed, and as the height of the knee-joint plays no part in the mechanism of the trotter, the increased length of the fore-limb does not influence its speed in any way. It is therefore the hinder-part that impels the fore-part in trotters

TABLE II — *Table of percentages*

	Peter Manning	Uhlan	Lee Axworthy	Arion Guy
Height at withers	160 $\frac{1}{3}$	158 $\frac{1}{8}$	152	155 $\frac{1}{2}$
Height of croup	158 $\frac{3}{4}$	156 $\frac{7}{8}$	152	153 $\frac{1}{3}$
Total body length	157 $\frac{1}{2}$	160	151 $\frac{1}{8}$	153
Head length	66	63 $\frac{1}{8}$	57 $\frac{1}{8}$	63 $\frac{1}{2}$
Neck length	78 $\frac{3}{4}$	83 $\frac{1}{5}$	73 $\frac{1}{2}$	69 $\frac{1}{4}$
Girth of thorax at withers	175 $\frac{1}{4}$	177 $\frac{1}{5}$	172	164 $\frac{3}{4}$
Girth of thorax at middle of back	178	177 $\frac{1}{2}$	166	160
Height of shoulder point	94	86 $\frac{1}{3}$	86 $\frac{1}{3}$	89
Length of fore cannon bone	30 $\frac{1}{2}$	25 $\frac{1}{2}$	28	28
Upper circumference of fore limb	54 $\frac{1}{2}$	52	43 $\frac{1}{5}$	43 $\frac{1}{5}$
Circumference of fore cannon bone	20	20 $\frac{1}{3}$	19	19
From knee joint to ground	48 $\frac{1}{4}$	55 $\frac{7}{8}$	47	47
Height of stifle joint from ground	101	101	101	94
Height of point of hock	61	55 $\frac{7}{8}$	59	56 $\frac{1}{2}$
From point of haunch to point of hock	101	101	94	94
Circumference of posterior cannon bone	22 $\frac{1}{4}$	22 $\frac{1}{8}$	21 $\frac{1}{2}$	—
From stifle joint to point of hock	55 $\frac{1}{4}$	—	50 $\frac{3}{4}$	53 $\frac{1}{3}$
Width of haunches	61	55 $\frac{7}{8}$	47	45
Width of chest	37 $\frac{1}{2}$	42	35 $\frac{1}{2}$	35

Among the different measurements taken, one is of special importance, that of the upper circumference of the fore-limb. The more it is developed, the greater is the general development of the horse. Great speed is only attained by violent efforts. In the case of the 4 above-mentioned North American horses, placed in decreasing order of speed, the circumference of the upper part of the forelimb was respectively 34.06 — 32.93 — 28.33 — 27.77 % of their height at the withers.

Another important measurement depends on the size of the hind limb, this is the width of the croup from one haunch to the other. Of the 4 horses mentioned, the quickest had the widest haunches. The hock of the trotter is lower than that of the galloper. In the American trotter which was selected for speed alone, the hocks are lower than those of the French trotter, hence the superiority of the former animal.

This also teaches us that it is a great mistake on the part of breeders of trotters to use a thorough-bred English sire and that it is as absurd to have galloping races for trotters, as to make pure-bred horses take part in trotting races.

In the trotter, there should be considerable distance from the point

of the haunch to the point of the hock. The longer this distance, which should be 64 % of the height, the lower is the hock.

An examination of the pedigrees of the 4 American trotters studied shows them to be the products of close and continual inbreeding which proves that this method in the hands of a clever breeder can give good results. F D

## CATTLE

743 - **Cost of Maintaining Milch Cows in Michigan.** RIDDLE, I. T. and KURIZ W. J. in *Quarterly Bulletin Michigan Agricultural College Experiment Station* Feb 1921, and *The Creamery and Milk Plant Monthly* Vol. XI No. 2, pp. 3-33 Chicago Feb 1922.

The following figures on the cost of maintaining cows for the year ending April 30, 1921, have been collected from the Wayne and Monroe Counties (Michigan U. S. A.). Twenty-three dairy farms were studied and the average return per cow was 7104 lb of milk testing 3.33 % and yielding 236.8 lb butter fat. The average returns over the direct costs amounted to 91.91 %.

Out of the 23 herds in question 9 produced an average of 8178 lb of milk per cow making a net return of \$116.11. 11 herds produced 6218 lb of milk per cow with returns of \$87.11 over direct costs or \$29.00 less than the superior herds.

	dollars
548 lb ground oats	8.70
408 " muscical	6.64
14 " ground barley	2.53
14 " bran	3.50
486 " Commercial feeds	13.07
260 " hay (chiefly alfalfa)	24.04
1660 " other dry roughage	6.32
8722 " silage	21.50
424 " other succulent feeds	10.00
23 weeks pasture	14.47
42 lb litter	1.15
<b>Total feed costs</b>	<b>\$ 103.36</b>
Feed and litter costs for steer and bull per cow	17.57
Decreased inventory	5.17
Miscellaneous expenses (veterinary, etc.)	6.76
<b>Total direct costs</b>	<b>\$ 133.66</b>

These do not include labour costs, nor depreciation charges or buildings and equipment which are treated as general expenses, in order to render account keeping much easier and more readily comparable.

The average monthly labour requirements viz. hours of manual labour, per cow and per unit of young stock including bull, are shown as follows (from January onwards): 140 and 44, 128 and 40, 148 and 38, 147 and 43, 136 and 25, 121 and 21, 106 and 21, 104 and 20; 103 and 20, 111 and 21, 127 and 31, 140 and 45. Total for whole

year 151.1 and 36.9. Horse labour required 15 1 hours per cow per year, car or truck travelled a distance of 20 miles per cow. The average wage amounted to \$249 per hour (including board)

The investment per cow is: buildings, \$188 18, stock \$157 32, equipment \$11 55 Total \$357 05

Cost per animal unit (entire herd), respectively \$180 46, 126 60, 9 29, total \$316 36

The average returns per cow were

	dollars
Milk sold 6054 lb	170 82
Cream sold 29 lb	5 36
Dairy produce used at home 161 lb	4 45
Milk fed stock other than dairy (skim milk) 155 lb	0 55
Stock sales less purchases	21 55
Manure 5 63 tons	17 27
Miscellaneous	2 87
<b>Total returns</b>	<b>\$ 225.57</b>
<b>Net returns per cow</b>	<b>\$ 91.91</b>

The above figures refer to 425 dairy cows, 125 yearlings, 78 calves and 21 bulls, a total of 528 animal units (1 animal unit = 1 cow, 2 yearlings or 4 calves)

744 - **The Water Buffalo in the Northern Territory of Australia.** — *The Pastoral Review*, Vol XXXI No 5 pp 625 629 Sydney and Melbourne Aug 1921

The vast Northern Territory of Australia is essentially pastoral

Satisfactory results have not yet been obtained with European imported stock owing to the serious losses through diseases prevalent in this region. It is stated that a wiser plan would be to substitute the zebu and particularly the water buffalo as Eastern stock is far more resistant to disease

745 - **Advantages of Heavy Feeding of Milch Cows.** — ROSS H A in *Circular* No 250 Illinois Agricultural College and the Creamery and Milk Plant Monthly, Vol XI No 3, p 35 Chicago, March 1922

The author states that the present prices of butter fat make it possible to dispose of farm produce at prices much above their present market value, when heavy feeding of cows is practised

In Illinois, good cows are returning 85 cents per bushel for maize, \$24 per ton for hay and 89 50 per ton for silage on the 35 % butter fat basis. These results have been obtained from the Illinois Agricultural Experiment Station and refer to records for 528 cows

The average daily production amounted to 25 lb of 4 % milk per cow for the six months, November to April, and a total of 92 095 lb butter fat

The feeds consumed during the period were as follows for the 528 cows 893 688 lb concentrates + 831 954 lb. hay + 2 229 314 lb silage,

per cow respectively, 1 693 lb. + 1 576 lb. + 4 222 lb.; per lb. of butter fat produced, 9.7 lb. + 9.0 lb. + 24 2 lb.

These cows varied as to size, breed production and date of calving, but were typical of good milch cows found in Illinois.

If the concentrates in the ration consist of 2 parts maize and 1 part bran, and if the hay which is fed is a legume, the ration is well balanced and economical. With the bran costing \$18 per ton, cows like those studied, should give a return as follows: butter fat at 30 cents per lb. per bushel of maize, \$0.70; per ton of hay \$20 50; per ton of silage, \$8.00; butter fat at 35 cents per lb.; respectively (maize, hay and silage) \$0.85, 24.00 and 9.50; butter fat at 40 cents per lb. \$0 95, 28 00 and 11.00.

Only the feed costs are included in this estimation, the incidental expenses of the dairy and the value of the skim milk, are neglected.

Under existing conditions it is therefore evident that heavy feeding of milch cows is profitable, the increased grain ration is advisable as long as there is a corresponding increase in milk production, without a marked gain in body weight of the cow.

Where a legume hay is not available the ration maize + bran + silage + hay may be supplemented by linseed oil meal at the rate of 0.75 to 1 lb. per cow per day depending upon the amount of milk produced.

F. D

#### SHEEP

746 — **Shropshire Sheep; Distribution during Recent Years and their Value for Crossing.** — MANSELL, A., in *The Journal of the Ministry of Agriculture*, Vol XXIX, No. 1, pp 44-50, figs 2 London, April 1922.

Towards the end of 1882, breeders of Shropshire sheep established the first Sheep Breeders Association of the world, and the following year the first Flock Book was published. The formation of the association was hastened to some extent by the great demand for Shropshire sheep for export to the United States and Canada, and the buyers were asking for certificates of purity and origin.

It is estimated that no fewer than 20 000 Shropshire sheep were exported during the first 10 years of the Flock Book's existence and this activity has been maintained ever since, either for crossing with Merino or native breeds, or to raise pure bred flocks which would furnish rams useful either for wool value or meat and early maturity.

In the United States, the Shropshire breed, occupies the first rank amongst the pure breeds, in 1920 the total number was 124 453 out of 463 504 pure breeds, i. e. 26 5 %, Rambouillets next and then Merinos. A similar position exists in Canada.

Abundant testimony is at hand which demonstrates the value of the Shropshire breed for crossing purposes, in North America, New Zealand, and Tasmania.

The present prices for first-class animals is given as follows: rams 80 to 150 guineas, ewes 12 to 15 guineas, best quality rams 20 to 40 guineas; ewes 7 to 8 guineas.

Some 150 to 175 lambs per 100 ewes is the usual average; the ewes



are great milk yielders and the breed flourishes in all types of climate, humid or dry, at high altitudes or at sea level. The sheep may be kept between hurdles indefinitely, but better results are obtained if kept on pastures for the greater part of the year. F. D.

747 — **Data to Serve as a Basis for the Development of a Systematic Pastoral Industry in Cyrenaica.** — PROVENZALE, P., in *Allevamenti*, Vol. VII, Part 4, pp. 112-114. Palermo, April 1922.

The native of Cyrenaica breeds sheep only for meat production, though he makes butter from the ewes' milk. In the authors' opinion, excellent cheese could also be made from the milk, and the wool would find a ready market in Italy, where it is much needed to supply the textile industries for which before the War some 200 000 quintals of wool were imported from abroad.

Since the number of sheep kept in Europe and America is continually decreasing, it would be most advantageous to Italy to be able to draw much of her wool supplies from her own colony.

Latium is unable to satisfy the ever-growing demand for sheep-milk cheese of the Roman type; new markets for this product are daily opening, not only in all the Provinces of Italy, but also in America and Northern Europe. Roman "Caciari" were first started in Montenegro, and later in Sardinia (which became, towards 1900, the largest market), Lombardy and Albania.

The North African sheep is naturally, without any selection, remarkable for its hardiness, thrift, resistance to long journeys, and prolificness. The following figures show the returns on native flocks.

*Receipts:*

Butter . . . . .	1.250 kg.	at 10 lire	12.50 lire
Wool. . . . .	2.5 kg.	at 2.50 "	6.25 "
Lambs . . . . .	1 1/2 (3 in 2 years)	at 40.00 "	60.00 "
		lire	78.75

*Expenditure:*

Maintenance . . . . .	10	lire	
Risks and depreciation 15 % . . . . .	18	"	28 lire

*Net return . . . . .* 50.75

Value of sheep 120 lire.

thus the interest obtained is 42 % of the worth of the animal.

If the amount of milk used in cheese-making is equivalent to that producing 1 kg. of butter (13 to 15 litres) 1.5 kg. of cheese + 1.4 kg. "recuite" could be obtained and sold respectively for 10 and 5 lire per kg. A yearling sheep fetches 80 lire: choice wool, of which each sheep produces 2 kg., is sold at 2 lire a kg. The author reckons the cost of one sheep per annum at 30 lire to which must be added 10 % of its value, viz. 12 lire, to cover risks and losses.

He shows that it would pay better to substitute cheese manufacture for butter making.

During the very dry spring of 1921, the author obtained the following figures which may be regarded as the minima :

in full lactation (1 month after lambing) from 0.61 litre to 0.72 litre per head, per day : average 0.66 litre ;

at the end of lactation (4th month), 0.15 to 0.18 litre ;

average 0.166 litre ;

approximate daily average for the whole period (3 months) 0.45 litre ;

yield per head in the 90 days of lactation following the weaning of the lamb  $0.450 \text{ litre} \times 90 = 40.5 \text{ litres}$ . From this milk 18 % of fresh cheese can be obtained, or 6.2 kg. of ripe cheese (15 % being lost during the ripening process) and 12 % of "recuite" made from the remaining serum, this represents a little over 3 kg.

The yield of the Sardinian sheep should, however, be still higher. If these animals are to be imported, the Campidano type is the one to choose; the sheep of this region have some Berber blood owing to repeated crossing with Algerian and Tunisian animals which as compared with the Sardinian mountain variety are taller, produce wool of better quality and a higher meat and milk yield. This breed however needs the care which only Europeans are able to give it, if the flock is to be entrusted to native shepherds, it is best to choose the Sassari sheep as this is very hardy. There is always in any case a higher death rate in imported flocks, especially among the young lambs, and the meat and wool are of less value than those obtained from the indigenous animals.

The Sicilian sheep has already been introduced into Cyrenaica by colonists from Sicily.

No additional pasturage is required for sheep-breeding in Cyrenaica, for the Berber, as a rule, allows the flocks to graze freely on his land being well aware of the advantage it derives from the passage of the animals.

F. D.

#### 748 - Sheep-Breeding in the Ancient Daunia (Italy) and the "Carapellesi" Sheep. —

ROSARIO, P., in *Allevamenti*, Year II, No 4 pp 112-113, Palermo, April 10, 1921, No 8, pp 253-257, August 1921; No 12, pp 125-126, 1 fig December 1921, Year III, Parts 1-2, pp 31-39, figs 4 January, February 1922

This is a study of the movements of flocks in Italy and the natural, ethnological and political conditions that have governed it from pre-historic times, through the ancient civilisations right up to the present day. The author draws his information from various sources and bases his article on copious archaeological historical, ethnological and geological data.

One of the most important meeting places of the routes followed by travelling flocks on their way from Apulia to the Abruzzi, or back again, was the ancient Daunia a small part of Apulia which is traversed by a net-work of tracks and lies between the streams of Celone and Ofanto and is crossed by the torrent known as the Carapelle (the Latin Daunus).

The name « carepellesi » is given to sheep having entirely and perman-

ently black fleeces, which were more prized in ancient times than white fleeces, owing to the backward condition of the art of dyeing at the time, sheep with more or less reddish, or brown, wool are known as "iezze".

The "carapelleso" belongs to the same Syrian race as the Karakul (*Ovis Aries asiatica*), and has like the latter a curl fleece but its black colour persists throughout its life, whereas the Karakul becomes grey when adult. The "carapelleso" is thus very suitable for crossing with the Karakul. The author suggests that these crosses might be effected at the National Sheep-Farm which the Ministry of Agriculture is about to start at Foggia. F D

749 - **Progress in Pig Breeding in England.** — *The Field*, Vol CXXXVII, Suppl to No 3574, p VI London, 1921

A review of the Shows held during 1921, indicates that pig breeding has made remarkable progress during and since the war. The increasing tendency to displace mongrel stock by pedigreed strains is evident, which indicates a growing membership of breed societies.

The utility value of the cross-bred pig is acknowledged. The stock raiser does not attach much interest to exhibitions but rather to the commercial market. However, it is evident that the above tendency will have an indirect bearing on the business possibilities, as it should result in improvement of breeds. The pig keeper who can observe the inherent characters of bought stock (often with young stock the characters are not easily discernible and some knowledge of lineage is essential) should be able to judge more readily the value of the pedigree animals on the market.

Amongst the systems of management, the simplest and most primitive is the most commonly employed, namely to allow the pigs to run wild on rough ground, with shelters for sleeping purposes. This has economic advantages, suitable also for pure breeds. The pig is one of the most sensitive of animals in regard to its food and comforts, and the vital factor is, therefore, the skill of the stockman in feeding and tending the stock.

Attention is drawn to the multiplication of breeds in recent years. 4 standard breeds are especially striking. Large White, Middle White, Berkshire, Tamworth. The Large Black has become popular and several others are also registered. E F

750 - **The Large Black Pig in England.** SPINCE, R S in *The Journal of the Ministry of Agriculture*, Vol XXIV No 1 pp 50-53, tables 1 London, April 1922.

The popularity of this breed has increased enormously since the formation of a society to register the pedigrees. For some time the Large Black appears to have had a dual origin, varying slightly in type, and raised in the Counties of Essex, Suffolk and part of Cambridge, and also in the South-West of England. An interchange of the two types has resulted in the present breed, prolific, early maturing, hardy, voracious, gives good quality pork, well suited for bacon, sausages etc.

It is admitted that no breed is superior to Large Black for crossing with Large White boars. The pork of the mixed breed is superior in quality and quantity. Large Black has now extended to all parts of England and Wales and has reached Scotland, where until recently breeding of pigs was not very general. In Ireland successful crosses have been made with Large Blacks and Large White, or Large White Ulster boars for use in bacon factories etc. It apparently is adaptable to the climate of South Africa, where all other introduced pure breeds have degenerated quickly.

The members of the breeders Society numbers about 1700. The percentage scale of points is adopted and is here described. The maximum is given to the back (15) which should be long and level, and to the hams (10 points) which should be large and well-filled to the hocks (1).

F. D.

751 - **Effect of Rationing on the Development of Pigs.** — SWANSON, C. O., in *Journal of Agricultural Research*, Vol. XXI, No. 5, pp. 279-341, figs. 22, tables 25, bibliography of 11 works. Washington, D. C., June 1921.

A brief survey is made of previous investigations on the effect of ration on the development of pigs, followed by a description of the authors' own experiments forming part of a series of experiments begun at Kansas Agricultural Experiment Station in 1911. Young growing pigs were taken and one group was fed on maize alone, another on maize and bone ash or rather, "synthetic ash", a mixture of calcium phosphate, potassium phosphate, sodium chloride, calcium carbonate, sodium citrate, sodium tartrate and ferric citrate in the following proportions: 10 : 37 : 20 : 92 : 15 : 8 : 2. Another group received maize supplemented with feeds calculated to supply the protein or ash deficiency, or both such deficiencies. At the beginning of the experiment a few pigs were slaughtered, analysed and weighed. At the close of the trial one pig from each group was similarly treated. The results given in the Tables and figures are described in detail under four headings.

1. **CHEMICAL COMPOSITION OF PIGS AS INFLUENCED BY THE CHARACTER OF THE RATION.** — Pigs fed with a ration deficient in ash or protein had a very restricted growth. The composition of their bodies was characterised by wide variations among the different animals; generally a low fat and a high moisture content.

Pigs fed on a partially deficient ration, but sufficient to produce a restricted growth, had a high fat content.

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(1) This breed, is gaining ground in Italy, where it has been recommended to replace the Large White, useful for transmission of characters such as early maturity and high production, but to the detriment of rusticity and especially the possibility of allowing to run free. The first breed should be kept to piggeries, where the products are disposed of in the homestead; the second should be suitable for rough ground and fattening on acorns. See R. Aug. 1921, No. 842. (Ed)

With pigs fed on a ration balanced in respect to protein and ash requirements, the moisture and fat content were nearly equal, with a tendency for the fat percentage to be somewhat lower than the moisture percentage. With pigs weighing less than 225 lb., whose ration was partially restricted, the fat content was higher than the moisture content.

A pig fed with a ration sufficient to produce a large and rapid growth and weighing over 225 lb. showed an increase in fat percentage with the increase in weight. The moisture percentage however decreased. The prolonged feeding of a deficient ration produces the same result, provided the pig attains a large size. The percentage of protein decreased with the increase in size, due to a large increase in the fat percentage. If the percentage of protein is calculated on the basis of body weight less fat, the percentage did not show any tendency to decrease with the increase in size. The same calculation applies to the ash percentage.

The general character of the ration affects the composition of the body as follows. A large amount of protein or ash will not produce a pig with a high protein or ash content. Such a ration will produce a rapid growth, and the pig will have the same composition as a pig of the same size, fed on a ration deficient in protein or ash, but taking longer time to develop. A large amount of ash in the ration will not materially influence the percentage of ash in the body. There is a closer relation between a pig's size and its composition than between the character of the ration and the pig's composition. If growth has not been too much restricted, the composition of a slaughtered pig of given weight may be used to calculate the weight of the chemical constituents in a living pig.

Attention should however be paid to the conditions under which the pig was raised.

II. CHARACTER OF RATION IN ITS EFFECT ON THE DEVELOPMENT OF LUNGS, HEART, LIVER AND KIDNEYS. — The specific character of the ration has, in general, the same effect on the development of the internal organs as on that of the body as a whole. Consequently a ration that will produce a rapid development of body weight will produce also a similar development of the internal organs. There is a distinct variation in the size of the internal organs quite apart from the composition of the ration. The relative smallness in some pigs of restricted growth, may be attributed to over-development of fat.

II. RELATION BETWEEN THE AMOUNT OF CHEMICAL CONSTITUENTS CONSUMED DURING THE FEEDING TRIALS AND THE AMOUNT STORED. — Pigs fed on maize alone store on an average 1 lb. of protein per 7.5 lb. protein consumed, provided that before the rationing is begun they have attained a certain size.

When maize was supplemented with proteins from milk (from  $\frac{1}{8}$  to  $\frac{1}{10}$  of the total protein in the ration), the pigs stored 1 lb. of protein per 5.11 lb. consumed. If supplemented with a medium amount of milk protein ( $\frac{1}{3}$  to  $\frac{2}{3}$  total), the pigs stored 1 lb. protein per 3.5 and 6 lb. consumed, respectively.

The most efficient ration is one which contains a small amount of

protein from milk combined with other feeds so as to give a wide nutritive ratio. When maize was fed alone, the total ash, fat and body protein stored was 1.1 lb per lb of protein consumed, supplemented by a small amount of milk protein it was 1.46 lb, and when supplemented by a medium amount of milk protein, 1.41 lb, when a large amount of milk protein etc was used, the body protein stored was less than 1.1 lb that is, a less efficient storage of nutrients than when maize was fed alone. These comparisons do not take into account the rate of growth.

The largest amount of storage of ash, fat and body protein in relation to the amount of protein in the feed was produced with a ration possessing a high nutritive ratio.

Nine out of the 24 pigs under observation stored more than 1 lb of fat per lb of protein consumed. Amongst these, the 4 which stored the largest amount of fat were fed with rations having a wide nutritive ratio. Most of the 24 pigs studied stored 0.8 lb to 1 lb of fat per lb of protein consumed. The source of protein did not seem to have any particular influence. The 2 pigs fed until nearly 3 years old which depended solely on the maize for protein stored as much fat as the younger pigs which received protein from other sources. The former stored less thermes (in proportion to the thermal value of the feeds consumed) than the pigs whose ration contained protein from animal sources. From the standpoint of energy storage the small amounts of milk protein were as efficient as but not more than the larger amounts. The feeding of maize alone is also not satisfactory. The addition of a small amount of protein from other sources ( $\frac{1}{3}$  to  $\frac{1}{10}$  of the total) is as efficient as when  $\frac{1}{2}$  or more of the protein comes from other sources.

IV EFFECT OF PROLONGED FEEDING OF MAIZE ALONE, MAIZE + ASH, AND PROTEIN-FREE SKIM MILK ON THE GROWTH AND DEVELOPMENT OF PIGS — The more important results obtained in this section of the experiments are shown in the adjoining Table.

Two pigs each 3  $\frac{1}{2}$  months old one fed on maize + ash, and the other on maize + protein free skim milk did not develop satisfactorily, for the first 500 days and then for 400 days showed satisfactory development. Another pig 4  $\frac{1}{2}$  months old fed on maize alone increased in weight very slowly for 300 days but afterwards there was a more rapid gain for the next 400 days which became still more rapid in the last 360 days of the experiment. When maize was the sole source of protein in the ration the proportion of protein stored to protein consumed was 1.7. This ratio was obtained when the maize was fed for a prolonged period "900 days". This agrees with the ratio obtained in several other cases, when maize was fed for a period of 180 days. This appears to be the limit of the possibilities of protein storage with maize.

The 2 pigs, one fed on maize + ash and the other on maize and protein free skim milk, stored 1 therm for 18.82 consumed, during the first 400 days of the experiment. During the last 500 days they stored 1 therm for 3.19 consumed. The pig fed on maize alone stored 1 therm for 8.23

consumed during the first 600 days During the last 400 days, 1 therm was stored for 2.93 consumed

*Proteins consumed and stored and thermic ratio  
in nutrients consumed and stored*

Period	Protein consumed lb	Protein stored lb	Ratio	Therms in nutrients consumed	Therms in nutrients stored	Ratio
<i>Pigs fed on maize + ash</i>						
(a)						
0 to 100	11.2	1.54	—	203.89	14.62	13.94
100 to 200	6.73	0.99	—	116.96	9.40	12.33
200 to 300	6.59	1.32	—	121.49	12.54	10.5
300 to 400	9.43	0.77	—	163.93	19.91	8.23
400 to 500	13.84	2.97	4.66	240.69	52.14	4.61
500 to 600	22.77	3.53	6.45	396.00	117.03	3.38
600 to 700	22.00	3.70	5.95	382.56	104.32	3.67
700 to 800	37.04	7.41	5.00	643.99	227.64	2.83
800 to 900	54.10	10.26	5.27	940.67	292.05	3.22

*Pigs fed on maize + protein free skim milk*

(a)						
0 to 100	7.86	0.44	—	136.70	4.17	32.78
100 to 200	7.56	0.55	—	131.42	5.22	25.17
200 to 300	7.91	0.22	—	137.61	2.09	10.5
300 to 400	10.09	1.10	—	175.49	23.89	7.34
400 to 500	14.36	2.75	5.23	250.08	50.06	4.99
500 to 600	21.67	3.41	6.36	376.85	115.96	3.25
600 to 700	21.23	7.00	3.03	369.19	173.04	2.13
700 to 800	39.47	6.17	6.40	686.25	208.08	3.30
800 to 900	41.08	3.75	10.84	714.22	224.57	3.18

*Pigs fed on maize alone*

(b)						
0 to 100	9.07	0.44	—	157.70	4.18	37.72
100 to 200	17.75	1.10	—	187.04	10.45	17.90
200 to 300	11.66	1.54	—	203.05	14.62	13.89
300 to 400	19.44	3.78	—	337.94	72.55	4.66
400 to 500	23.07	0.60	—	401.23	35.56	11.28
500 to 600	18.55	0.10	—	322.18	58.15	5.54
600 to 700	15.30	4.50	4.29	335.60	121.77	2.76
700 to 800	31.84	3.87	8.22	553.59	146.68	3.77
800 to 900	52.96	11.47	4.63	920.86	318.58	2.89
900 to 1000	65.23	5.99	6.53	1134.31	292.08	3.88
1000 to 1060	37.25	10.35	3.60	647.51	345.51	1.87

(a) The figures for the 3 1/2 months before the experiments are not available

(b) The figures for the 4 1/2 months before the experiments are not available

F.D.

[751]

## POULTRY

- 752 - **The Rate of Growth of the Domestic Fowl** (1). — BRODY S, (Missouri Agricultural Experiment Station, Columbia), in *The Journal of General Physiology*, Vol. III, No. 6, pp 765-777, figs 4. Baltimore, 1921.

This paper demonstrates the fact that the growing period of the domestic fowl is analogous to that of the mammal, being composed of 3 or possibly 4 cycles. Two of these are postembryonic with maxima at about 8 and 18 weeks respectively, varying somewhat with the breed; two or at least one, are embryonic with maxima at 11 to 12 and 15 to 16 days after birth. Hatching occurs during the first part of the 2nd or 3rd cycle. The velocity curves of each of these cycles are similar to and can be represented by the equation of an autocatalytic monomolecular reaction.

F D.

- 753 - **Nutrient Requirements of Growing Chicks.** — MUSSEHI, L F, HALBERSLEBEN, D A and SANDSTED, R U, Nebraska Experiment Station, in the *Journal of Agricultural Research*, Vol XVII, No 3, pp 139 150, 11 graphs Washington, Oct 15, 1922

Investigators in the field of nutrition have noted that chickens behave unlike rats or swine when limited to rations of one type, such as wheat or maize this led to an enquiry into the values and deficiencies of the common feeding stuffs used for poultry and egg production.

The author carried out a large number of experiments and proved that maize is not a satisfactory food on which to rear chicks.

The chicks chosen for the experiments were selected with great care, all were of the same age, viz, ten days, of equal vigour and development, and each group of nine was apparently uniform in all respects. The chicks were weighed individually every seven days and the figures obtained set out in graphs, the curves being typical of each group.

The ration was given in two parts, one as a coarse, the other as a fine feed; with the fine, or mash feeds, were mixed the supplementary ingredients, the effects of which the authors wished to study.

The results showed that maize is deficient in essential qualities, and is not suitable for the complete nutrition of growing chicks, which on this ration could not develop and ultimately died.

The addition of 5% of mineral substances, such as bone-ash, sulphur, salts of calcium, sodium and iron, were of assistance and made possible a slow, but continuous growth. The inclusion of maize gluten was ineffective.

The addition of 15% purified casein produced a marked improvement: it appeared that the casein supplied amino-acids, in which maize is deficient.

Supplementing the basal ration with other proteins, such as egg albumin and gelatin, lowered rather than raised the efficiency of the ration, and soya-bean meal was equally ineffective.

The addition of butter had no result. the fat contained substances which may have stimulated growth and so masked temporarily the lack of other essential accessories. There was a slight improvement in condition, followed by a loss of weight until the chicks died.

The addition of green foods brought about a decided improvement;



green wheat was given in abundance, and eaten by the chicks to the extent of about 5 %, dry weight, of the whole ration. The helpful influence of green food may have been due to an improvement in the physical condition of the ration, and to a stimulating effect on the appetite.

Further experiments are now being carried out to ascertain the specific action of green foods

With a ration formed of maize 65 parts, casein 15 parts, ash mixture 5 parts, starch 10 parts and unlimited green food, satisfactory growth to adult and egg-production stage was achieved, although the chickens were confined in a small pen under unfavourable conditions. L. V

**754 - Clover Flour and Grape-Pip Flour in Poultry Feeding.** — FRACANZANI G. A., in *Bassa Corte*, Vol. III, Parts 52-53, pp 1133-1136, figs 3 Molasana, Genoa, April-May 1922

The author draws attention to the fact that a habitual and liberal maize diet fattens poultry, but at the expense of egg production, and therefore suggests, in order to obtain a closer nutritive ratio viz., about 1 : 5, the admixture of cakes, clover, etc

Clover should be fed fresh when possible, but in winter, clover flour can be given, that is to say, the residuum after threshing, or the finely chopped hay after soaking in water for 10 hours

Clover and the meal made from it are rich in lime and thus aid in the formation of egg-shells

The author recommends rations containing clover flour, to some of them flour (cake) made of grape pips is also added, and makes an excellent paste which is too little appreciated at present

The following are daily rations for 10 tows: clover flour 230 gm. + wheat bran 180 gm + ground rice chaff 140 gm

Clover flour 170 gm + maize 110 gm + bran 120 gm

Morning: grape-pips flour 150 gm. + sesame flour 220 gm. + clover flour 180 gm, evening: oats (soaked in water for 24 hours) 150 gm + maize 200 gm

The author gives the results of some of his own experiments showing that egg production is increased by adding clover flour, or grape-pip meal to the paste fed to hens F. D.

**755 - Duck Hybrids.** - I LÉCAILLON, A., Sur les caractères d'un hybride issu de l'union d'un canard musqué mâle (*Carina moschata*) et d'une oie d'Égypte femelle (*Chenalopes aegypticus*), in *Comptes rendus de l'Académie des sciences*, Vol. 174, No 1, pp 68-69 Paris, January 3, 1922 — II IDEM, Sur les caractères d'un hybride mâle provenant de l'union d'un canard pilet mâle (*Dafila acuta*) et d'un canard sauvage femelle (*Anas boschas*), *Ibidem*, Vol. 174, No 13, pp 885-887, March 27, 1922 — III IDEM, Fécondité des hybrides obtenus par croisement du canard pilet mâle (*Dafila acuta*) et du canard sauvage femelle (*Anas boschas*), *Ibidem*, Vol. 174, No 22, pp. 1429-1433, May 29, 1922.

I. A brood hatched in the Toulouse Zoological Gardens contained, in addition to normal goslings, one male hybrid differing entirely in appearance from its parents. This bird which was the result of the cross *Carina moschata* ♂ × *Chenalopes aegypticus* ♀ might be regarded as com-

posed of a mosaic of characters some inherited from its father, e. g. size, absence of voice, colouration of plumage in the dorsal region etc., and the others from its mother, e. g. carriage, conjugal fidelity, plumage on ventral surface etc.

II. — In 1920, several hybrids were obtained in the Toulouse Zoological Gardens from mating a *Dafla acuta* drake with a common wild duck (*Anas boschas*). One of the ducklings was a male; the author describes its characters and compares them with those of the *Dafla acuta* and *Anas boschas* drakes

In some of its characters, this hybrid resembled more nearly the drakes of one or the other of the parental species, otherwise it was more or less intermediate between the two types of bird.

These two cases are instances of the class of hybrids in which the direct products of the mating of parents belonging to different species possess new characters, or else characters intermediate to a greater or less extent between those of the two parental species.

III. — The long-tailed duck (*Dafla acuta*) and the mallard, or wild-duck, mate readily both in the wild state and in captivity

Although animal hybrids are infertile (as are also the mules obtained by crossing the Barbary and domestic breeds of duck), the hybrids of the long-tailed duck and the mallard form an exception to the general rule which makes them especially valuable material to the student of the phenomena of heredity

The author has so far succeeded in breeding 3 classes of hybrids; 1) the direct offspring of two parents belonging to different species; 2) the progeny obtained by mating a male hybrid of class 1 with a mallard duck; 3) the products of the mating together of the hybrids of class 2.

F. D.

756 — **Problems of Incubation.** — LAMSON, G. A (Connecticut Agricultural College) in *The National Poultry Journal*, Vol II No 82, pp 396 397

The factors influencing incubation are numerous, they may be divided into factors having to do: 1) with the collection, selection and care of eggs before placing them in the incubator 2) with the handling and care of the eggs during incubation

At the World's Poultry Congress held at the Hague in 1901 the author presented the following rules, as a result of the study of the physiological development of the embryo and practical experience.

The eggs should not be kept more than 16 days previous to incubation and the freshest eggs are best. The temperature should not exceed 90° F. Eggs should be kept lying on their sides in a dry place, as moisture tends to increase the possibility of infection through the shell. Recent investigation has shown that there is little or no value in turning the eggs previous to incubation. Eggs laid early in the season and kept at low temperatures take longer to incubate.

It is not possible to determine sterility, fertility or sex from the size or shape of the egg

The use of large eggs for hatching is recommended on the ground that the size of the egg is a matter of heredity. Very large eggs however, as a rule do not hatch as well as medium sized eggs. Eggs with very porous or flaky shells with marked inequalities in thickness, do not hatch well. Very thin shelled eggs are likely to be broken during incubation. Excessively dirty eggs should not be used, and it may be advisable to wash eggs before incubation.

A thin muslin curtain tacked over the window will keep out direct sunlight and strong air currents.

Incubators should be set level in order to prevent warm places in the air chamber, incubators should be started 2 or 3 days before the eggs are placed in them.

To ensure the development of the embryo, without delay, the temperature should be regulated at 104 or 105° F before putting in the eggs and then maintained at 103° F. If the period of incubation is lengthened the tendency is to decrease the numbers of eggs hatched. The regulation of the temperature is of great importance, especially during the first 5 days of incubation. It is doubtful if varying the temperature during the three weeks of incubation has any advantages over a uniform temperature of 103° F.

Tests made with about 10 000 eggs using the calorimetric method in incubators with varying relative humidity gave the following results, which indicate that there may be a wide variation in humidity without much danger.

#### *Effect of humidity on incubation*

Relative humidity %	Average Loss of Weight per egg gm	% of fertile eggs hatched
70-80	3.0	55
60-70	4.10	57
50-60	5.61	55
40-50	5.52	10.2
30-40	6.57	11.5
20-30	5.22	14.5
15-20	7.74	14.7
		46.0

The method of incubation in rooms above a cellar has proved difficult owing to the fact that the conditions of humidity are very different from those in most rooms below ground level.

The practice of cooling eggs during incubation is not recommended. It is incorrect to say that cooling affects the vitality of chickens, out of 500 chickens, 34 had died at the end of 4 weeks, 20 of which had been cooled during incubation and 14 had not been cooled.

Ventilation may vary to a fairly large extent without any deleterious effect, only when the carbon dioxide reaches 15 % is the danger noticeable. If the ordinary incubator is well ventilated the question of carbon dioxide is negligible.

Eggs should be turned from the third day of incubation and at frequent intervals until at the point of hatching. It has been found that eggs turned at least 5 times during each 24 hours have given somewhat better results than those turned twice, and the latter showed an improvement on those turned only once. The common practice of turning each morning and evening is advisable from the economic standpoint. When turning it is advisable also to change the position of the eggs on the tray, thus equalising the effects of minor variations in temperature that may occur in the incubator.

The individuality of the hen has a marked influence on the vitality of the embryo; out of 1003 eggs laid by 18 hens, only 7 were sterile, whilst nearly 600 from the same number of eggs from other sources, were sterile. Hatching has varied from 90 % from some hens to 30 % with others. The choice of the mother hen is therefore probably the most important feature in incubation. There is less variation in vitality with the embryos of malebirds.

At the present time, the all important question is how to increase the vigour and strength transmitted from the hen to the embryo by means of wise selection of mother hens, proper feeding, good housing exercise, etc.

F. D.

757 - **Poultry Rearing in Cyrenaica.** — PROVENZALE, P. in *Bassa Corte*, Vol. III, Part 50, pp. 1057-1058. Molassana (Genoa), February 1922

The native fowl of Cyrenaica belongs to the type common to the whole of North Africa. Although known as the Arab fowl, it is the product of crossing several breeds introduced from different Mediterranean countries. It is a small bird with a net weight never exceeding 1 kg. The colour of the plumage varies, but is generally uniform; the crest is small, or rudimentary, and the legs grey. The hens often lay daily, except during the autumn months, and produce a large number of eggs (total weight about 50 gm), but they are not good sitters.

In addition to the common type of fowl there are many representatives of the "pollo sultanino". This bird is of Turkish origin and has a small crescent-shaped tuft behind the comb. A few birds with feather less necks are also to be found; they are natives of Transylvania, but are called "Scandria", in Cyrenaica, on account of their supposed Alexandrian (Egyptian) origin.

The colonists have quite recently imported poultry from Italy, but the breeding results have been negative for the following reasons: want of protection from the changes of weather, especially from the ghibli; the want of resistance of European poultry and their first crosses to contagious diseases such as a form of diphtheria, coccidiosis, and a slow type of avian pest. The native fowl recovers from all forms of diphtheria and becomes immune, though it remains a carrier of the disease.

Egg-production is a very paying speculation. Before the War, Tripoli and Misurata used to export annually from 8 to 10 million eggs to Malta, Italy, France and Tunisia.

The meat is fairly good in quality, but little in quantity, owing to the small size of the birds. Caponising the cockerels has not proved successful for many reasons. As regards the acclimatisation of foreign breeds, the author advises the poultry rearer to turn his attention to the "Marsalese" breed, the product of selection by Prof. Tuccì.

Pigeons, turkeys and ducks have all been reared with great success in Cyrenaica, but rabbit-breeding is a matter of greater difficulty.

F. D.

755 - **Poultry Feeding Methods employed by Experiment Stations in the United States.** — Atwood H. (West Virginia), in *The National Poultry Journal*, Vol II, No 56, pp 41-42 London, 1921

*Cornell (Ithaca N. Y.) Ration for laying hens.* — The scratch grain consists of a mixture of 200 lb of cracked maize + 200 lb wheat + 100 lb. oats. The grain is scattered in deep litter, in small quantities in the morning and more at night. The mash is composed of 200 lb. maize meal + 200 lb wheat middlings (white) + 200 lb meat scrap + 100 lb wheat bran + 100 lb. ground heavy oats. + 25 lb. oil meal + 4 lb salt.

This mixture is fed dry in the open during the afternoon. The amount of feed is so regulated that about twice as much grain as mash is consumed. This ration is recommended for all breeds. For heavier breeds however, the morning feed is limited so as to encourage exercise and a bigger consumption of mash. Green food, grit and oyster shell are also provided.

*Ontario Agricultural College.* — A small amount of whole grain is fed in the litter morning and evening, the quality depends on the price. Crushed oats is always supplied and sour milk or buttermilk forms the protein ration. Considerable care is taken that the supply of green food is abundant, mainly in the form of sprouted oats, then cabbage, rape, etc. Where no milk is available, a mixture of 4 parts oats and 3 parts shorts, barley; maize or buckwheat meal is recommended, at the rate of 15 % for the heavy breeds, and 20 % for lighter breeds.

*Storrs Experiment Station (Connecticut)* — The scratch feed is composed of equal parts by weight of wheat and cracked maize, the mash consists of equal parts by weight of wheat bran, maize meal, ground oats, flour middlings, beef and fish scrap. The dry mash is always available for the hens; the principal feed of scratch grains is given about 4 p. m., but in winter a small amount is also given in the morning to induce exercise. Grit, oyster shell, charcoal and green stuff are also provided.

*New Jersey State.* — The mash is always available for the hens in hoppers, sufficiently large to permit one filling to last from one to two weeks at least. The following mixture is recommended.

Every morning about 9 o'clock, in a deep litter about 5 lb. of scratching ration is fed to each 100 hens, composed of equal parts of wheat and

*Dry mash ration.*

Feed	Quantity	Protein	Carbohydrates + fat $\times$ 2.25
	lb.		
Wheat bran . . . . .	200	24.2	90.6
Wheat middlings . . . . .	200	25.6	121.4
Ground oats . . . . .	200	18.4	113.6
Maize meal . . . . .	100	7.9	76.4
Gluten meal . . . . .	100	25.8	65.6
Meat scrap. . . . .	100 to 200	66.2	35.1
Short cut alfalfa . . . . .	100	11.0	42.3
Total . . . . .	1 000	179.1	545.0

Nutritive ratio 1:3.02

oats (protein 10.2 and 9.2 % respectively ; carbohydrates + fat  $\times$  2.25 ; 73.0 and 56.8 % ; nutritive ratio 1:6.6).

From 4 to 5 p. m., depending on the season, a ration is fed composed of 10 lb. to each 100 hens, fed in litter : 2 parts cracked maize + 1 part wheat + 1 part oats + 1 part buckwheat.

The proportions of protein are as follows, respectively, 15.8, 10.2, 9.2, 7.7 ; carbohydrates + fat  $\times$  2.25 ; 152.8, 73.0, 56.8, 53.3 ; nutritive ratio 1:7.8.

*Wisconsin Agricultural Experiment Station.* — The typical scratch feed consists of 2 parts cracked maize + 2 parts wheat + 1 part oats or barley. The mash consists of equal parts of ground maize, gluten feed, bran, middlings and meat scrap, fed at the rate of 1 lb. mash to 1 lb. scratch feed. A small amount is thrown in at night after the fowls have gone to roost, or in the morning before they go out. The fowls have easy access to the mash all the time, and a light mast moistened with skim milk or buttermilk when available is provided at noon. Cabbage, mangels and sprouted oats are given in winter and rape during the summer.

*Maine Agricultural Experiment Station.* — The following method has been found satisfactory. For each 100 hens, 4 qts. of whole maize are scattered in the litter in the morning, and at 10 a. m., they are given, 2 qts. of wheat and 2 qts. of oats. Dry mash is always available, but it is stated that it is not advisable to feed pullets recently transferred to the laying houses on too rich a mash. During the first month (September) the mash consists of 3 parts bran + 1 part middlings + 1 part gluten meal + 1 part meat scrap. The second month : 2 parts bran + 1 part maize meal + 1 part middlings + 1 part gluten meal + 1 part meat scrap.

For the third month, the same as for second month, with the addition of  $\frac{1}{2}$  part oil meal. During the following months the oil meal is alternately added and omitted. Sprouted oats are generally used as green stuff.

A fair degree of uniformity evidently exists among the various Stations both as regards scratch feed scattered in the litter and the use of

animal protein feeds (meat scrap, skim milk etc.), and green stuff, grit, and oyster shell. The following standardised ration may therefore be determined.

*Scratch feed.* — 5 parts cracked maize + 1 part wheat + 2 parts barley + 2 parts oats.

*Mash.* — Equal parts of bran, wheat, middlings, maize meal, gluten feed, ground oats, and meat scrap.

F. D.

759 — **Bee-Keeping in Tasmania.** — OLDAKER, C E W, in *Department of Agriculture, Tasmania, Bulletin* No. 100, p 1-4, Feb 1921.

BEEKEEPING

The mild climate, the long duration of the spring and summer and the abundance of honey plants, renders Tasmania very favourable for the development of bee-keeping. The author makes practical suggestions, in an easily understood and concise manner, for the benefit of those who are interested in the industry.

E. F.

760 — **Acceleration of the Development of the Silk-Worm.** — SURCOUF J, in *Bulletin de la Société d'Histoire Naturelle de l'Afrique du Nord*, Vol XIII, No 4, pp 107-108, Algiers, April 14, 1922

SERICULTURE

It sometimes happens that silk-worms forgotten in their boxes and consequently deprived of food, yield normal cocoons, the adults are more or less atrophied, but transformation has been more rapid than in the case of worms which have received normal treatment in the matter of food and care.

Taking this fact into account, the author made experiments with *Anessa urticae*, *Spilosoma menthasstr*, and *Bombyx mori*, and discovered that through the action of the unused digestive secretion, the cuticle covering of the intestine was dissolved, the process of evolution took place and the metamorphosis was completed.

He then attempted to increase the action of the gastric juice of the worm in order to hasten its evolution. For this purpose, he sprayed water treated with trypsin and containing soluble salts of calcium on the leaves used as food for the worms. The digestive power of the silk-worm was thus considerably increased. The *B. mori* reared at a temperature of 23°-24° C, evolved in a fortnight. The number of meals was 20 during the first period of life; 17 during the second; 14 during the third; and 10 on each of the two days before the "mounting period. Generally rearing lasts from 28 to 30 days.

The author considers that by this process, the evolution cycle might easily be completed in 18 days without special preliminary treatment. The cost of the operation would thus be reduced and polyvoltine races could be raised capable of giving 4 generations in a limited period corresponding with the progress of mulberry-tree growth. At the same time an attempt might be made to accelerate the silk secretion in order to obtain a better yield.

P. C.

## FARM ENGINEERING.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

- 761 - Pump for Calzoni-Parenti Hydraulic Presses. — FREZZOTTI, G. (R. Oleificio sperimentale di Porto Maurizio) in *Il Coltivatore*, year 68, No 1, pp 12-15, 3 figs. Casale Monferrato, 1922

This new machine by the Firm Calzoni-Parenti, Bologna, for the olive oil industry, has been tested, with perfectly satisfactory results, at the experimental oil mills at Porto Maurizio (Liguria).

It is constructed with coupled pistons and may include 2, 4 or 6 pumps, capable of feeding the same number of hydraulic presses simultaneously, each pump working independently. The annexed diagram shows a cross section. There is another type working not only at high pressure, but also at high and low pressure, but in these cases each pair of pumps feeds one press only.

The special features of the apparatus are: 1) the brake system of the pump and pressure exhaust by means of differential pressure valves; 2) the control of the two pump pistons by a single eccentric, 3) automatic, continuous lubrication, 4) the power of throwing the pump-bodies out of gear by checking the counterpoise lever with a special bolt.

When the counterpoise has been correctly adjusted (after testing with the manometer scale corresponding to the maximum pressure desired), it is easy to determine the moment when the press has reached its maximum pressure, for the lever of the pump rises automatically. To lower the press, the lever of the pump is raised and fixed with the bolt; the pump is thus thrown out of gear, while the water in the press returns through the pump to the feed-reservoir.

Any recipient connected with the machine by a pipe may be used as a reservoir. (See diagram). F. D.

- 762 - Consumption of Coal and Electricity in Machine Threshing. — TABGEN, in *Die Landmaschine*, Year 11, No 17, pp 309-311 Berlin, April 29, 1922

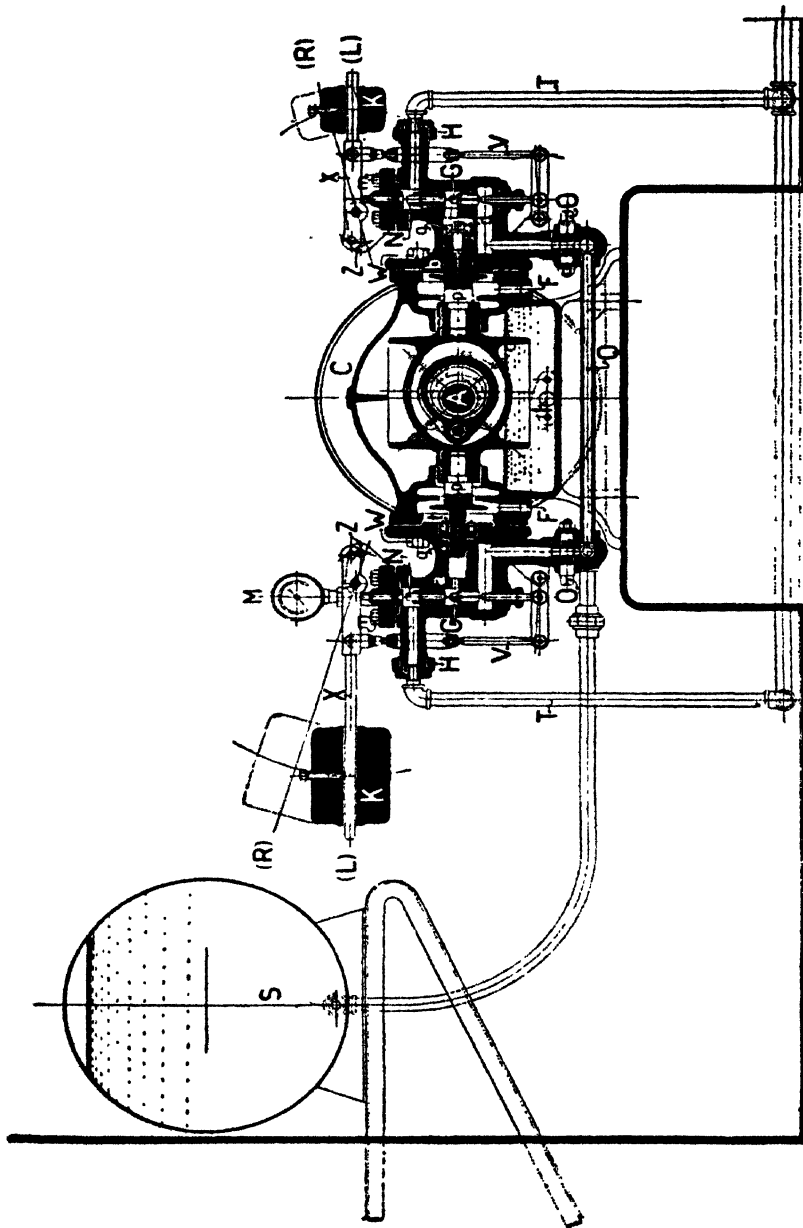
An experiment made in Germany to ascertain whether the electric motor is more economical than the portable engine in machine threshing.

A Wolf 1908 superheated steam portable engine was used. It had formerly been used in threshing and sawing and was characterized by the following: 12 atm. working pressure, 22 HP normal, 31 HP maximum continuous, 36 HP maximum. The only repairs executed were: changing the piston rings in the summer of 1921 and soldering the superheaters damaged by rust.

The motor was a Siemens-Schuckert alternating current of 40.8 HP and 955 revolutions a minute; it was connected by a cable with a transformer placed near the high tension wire. There was an amperemeter on the carriage of the motor and a kilowattmeter on the transformer.

A Wolf 1921 threshing machine was used: the drum was 1680 mm. long and 620 mm in diameter and the threshing machine had an automatic





Cross section of the "F. N. Calzoni-Parenti" type of pump. On the left is the water reservoir S. When the levers are in the position (L) the pump bodies are in action; when they are in the position (R) the pump bodies are at rest.

feeder and large and small fans: there were no accessories, such as screens for dead leaves, chaff, stubble, etc.

The rye-threshing experiment gave good results, the straw-grain

ratio being 1: 1.3. The grain, straw and chaff were weighed and the total corresponded with the weight of the sheaf.

Four tests were made on the 12th and 13th December, 1921:

I.	A test on 12th Dec., from	1.37 p. m.	to	4.7 p. m.	by electric motor
II.	" " " 13th " "	8.24 a. m.	"	10.54 a. m.	by portable engine
III.	" " " " " "	11.30 " "	"	1.30 p. m.	by electric motor
IV.	" " " " " "	2.4 p. m.	"	4.22 " "	portable engine.

This last test really lasted 2 hours because there were two interruptions of 18 minutes (altogether) caused by the driving-belt.

The kilowattmeter was read before and after the experiment and the coal was weighed.

The straw from the 3rd and 4th tests was loaded on a separate wagon and again thrashed on the 14th December, the rye-straw first thrashed by the portable engine being worked by the electric motor, and vice-versa. No difference was observed between the two systems, the straw containing no grain in either case. The consumption of electricity was 73 kwh; that of coal containing 6900 to 7600 calories was 225 kg divided as follows:

	kg.
Lighting . . . . .	41.50
Power . . . . .	170 00
Interval of 2h 30. . . . .	12 00
Interruptions of 18 mins. . . . .	1.50

As will be seen, little power was required. This was due to the fact that the axles of the thresher were fitted with ball-bearings and that there were no accessories, which absorb much power.

The results of the experiment show for an average day's work of 9 hrs.

(1) For the electric motor:

Grain . . . . .	175	qx
Consumption of electricity. . . . .	157.5	kwh
" per quintal . . . . .	0.904	"

(2) For a portable engine of 13 years service:

Grain. . . . .	194.5	qs.
Coal. . . . .	420	kg.
Consumption per quintal . . . . .	2.16	kg.

The prices ruling at the time were:

1 ton of coal. . . . .	440 marks
1 kw . . . . .	2 mks 77 pf.

The price of the best quality of coal used in the threshing was 463 mks per ton; adding transport and other expenses, this amounted to 500 mks.

The maximum daily consumption of oil may be estimated at:

	kg.
1) for the motor and transformer. . . . .	0.3
2) " " portable engine. . . . .	1.5

Consequently the consumption per quintal amounts to :

1) by electricity .	kg 1 6
2) with coal .	8 0

At the time the experiment was made, oil cost 20 marks per kilo ; consequently the cost of threshing per quintal of grain was

(1) by electricity

			mks
Current	0 104	× 2 77	— 2 52
Oil	1 6	× 0 02	= 0 04
			—
			mks 2 56

(2) with coal

Silesian coal	1 10	× 50	1 05
Oil	5	× 0 02	= 0 10
			mks 1 4

The higher cost of threshing by electricity is not compensated in any way, for the expense of installation, sinking fund, interest, labour, etc is the same as, if not more than that of threshing with a portable engine. Even as regards the staff required, no economy can be effected, for one mechanic is always needed, whatever machine be used. In addition, in regular working, with the portable engine, a better use is made of the fuel, indeed it has been observed that in summer the consumption of coal per quintal of grain is not more than 1 90 kg. The greater consumption during the experiment is due to the low temperature in the month of December and still more to the unfavourable conditions in which the portable engine was working, 4 ½ hours in all, with 3 interruptions, the first for 2 ½ hrs the second of 5 minutes and the third of 10 minutes. In spite of this, the consumption of 2 16 kg should be considered as a proof of the economy of the portable engine, especially when it is considered that it had been working for 13 years. Further, improved portable engines now exist, with a coal consumption of about 20 % less, that is, of 1 6 kg to 1 3 kg per quintal of grain. E P

## RURAL ECONOMICS

763 - Cost of producing Wheat on 481 Farms in the States of North and South Dakota, Minnesota, Kansas, Nebraska and Missouri for the Crop Year 1919. — COOPER, M R and WASHBURN R S (Assistant Farm Economists) in United States Department of Agriculture, Bulletin No 913 Contribution from the Office of Farm Management and Farm Economics pp 1 59 figs 9 Washington D C, 1921

The authors state that to be of any real significance, cost figures must be presented in terms of the ranges that exist in the final cost per unit of production and in the various elements of cost. The variations in the cost per unit of production in any representative farming area

are so marked that they should be considered in any case where cost figures are concerned. From the presentation of the range of costs of farm products, it would appear that usually from 40 to 50 per cent of the production involves expenditure above the average. It follows that the cost that will cover the "bulk" of the production of a given product is the figure that approximates to what the price should be to maintain the industry. This consideration has led to the development of the "bulk-line" theory which has recently assumed an important place in the discussion of the relation of production costs to price. The "bulk-line" theory is a modification and an attempt at practical application of the "marginal cost" or "greatest cost" theory of the relations of cost and price. In practice, the "bulk-line" has sometimes been drawn to include 85 per cent. of the production, but this is merely a tentative and more or less arbitrary figure.

In reality the position of the "bulk-line" varies with different commodities and from time to time, according to the alertness with which farmers adjust their production to market conditions. The "bulk-line" cost corresponds to the long-period average price which is essential, one year with another, to stimulate the production of the amount of product which the market demands. What this "bulk-line" cost will be depends upon a number of factors, including the rate the farmer must pay for land, labour and capital, and the standard of living which farmers, as a class, insist upon if they are to remain on the farm.

The purpose of the present bulletin is to give a statement of facts concerning the cost of wheat production for the area and season covered by the survey: United States western and northern plains and the crop year 1919

Tabulated cost data were obtained from 481 records, of which 197 were made in five representative counties of the principal spring-wheat States, North and South Dakota and Minnesota, and 284 in nine counties in Kansas, Missouri and Nebraska, important winter-wheat States, and furnish the basis of this analysis of the average cost and variation in cost on individual farms and groups of farms in each area visited, as well as the more important reasons for the great variations in cost per acre and per bushel on individual farms. A total area of 43 940 acres sown with winter wheat, yielding 635 124 bushels, and a total area of 44 218 acres seeded for spring wheat, with a total production of 362 047 bushels for the crop year 1919, were involved. The results are summarised as follows:—

*Cost per acre* · Spring wheat, \$12.98 to \$47.84; average, \$22.40. Winter wheat, \$10.55 to \$50.23; average, \$27.80

*Cost per bushel* · Spring wheat, \$1.15 to \$14.38; average, \$2.65. Winter wheat, \$0.96 to \$8.74; average, \$1.87.

*Yield* · Spring wheat, 20.8 bushels per acre to less than 1 bushel; average, 8.4. Winter wheat, 30 bushels per acre to 2.2; average, 15.19.

The average yield of spring wheat was 9 bushels per acre in the United States as a whole in the same year, 1919, and the average yield for all

winter wheat in 1919 was 14.7 bushels per acre. The largest number of spring-wheat farms fell within the group having a yield of from 5 to 10 bushels per acre, while the largest number in the winter-wheat districts were included in the group having a yield of from 15 to 20 bushels.

The difference between the gross cost and the sum of credits for pasture and any straw utilised on the farm is taken to be the net cost of producing wheat. The average cost expense of each item was computed on a basis obtained by dividing the total cost of each item by the total wheat acreage. An analysis of the total cost for spring and winter wheat shows that labour accounts for about 32 to 35 % of the total cost of production, thrashing about 8 %, materials from 10 to 17 %, land rent from 24 to to % and other costs from 17 to 19 %. The difference in cost per bushel of producing spring and winter wheat is due to a lack of relation between the cost of producing an acre of wheat and the yield obtained, the cost per acre of winter wheat being 24 % greater than for spring wheat. In the spring-wheat area about 33 % of the production was on the farms having costs above the average ; in the winter-wheat area about 40 per cent of the production was on farms having costs above the average.

Summaries of costs by districts, range in cost per acre by counties, net cost per bushel, variations in items of cost, area of farms according to cost per bushel by counties, cumulative percentage of acreage grown at various bushel costs, cumulative percentage of total production, and individual costs per acre are tabulated and discussed. G. A. B.

764 - **The Cost of Production of Wheat, Beet, Potatoes and Milk in France.** -- GIRARD H. in *Bulletin de la Société des Agriculteurs de France, Supplément du Bulletin d'avril 1922, Comptes rendus de l'Assemblée générale de 1922, Section 2*, pp. 39-45. Paris, 1922 (1).

The French Minister of Agriculture has recently ordered a periodical enquiry to be made in order to compare the prices realised for agricultural produce and those charged by the retailers to the consumers. At the same time, the French Farmers' Association has decided to take the opportunity at their annual meeting to examine the economic situation of farmers in 1912-13 as compared with 1920-21 so far as the chief products of the soil are concerned, in order to collect information which will be of use in the Parliamentary debates.

The author has to report on wheat, beets, potatoes and milk, which together represent about a third of the area cultivated and a third of the money realised by French agriculture. He has ascertained the cost of production by adding the total outlay which is undoubtedly involved, to the general expenses (per ha), that is : upkeep of material and maintenance by the tenant of buildings and farmyards, farming, taxes, insu-

(1) See also: MINISTÈRE DU TRAVAIL, STATISTIQUE GÉNÉRALE DE LA FRANCE ET SERVICE D'OBSERVATION DES PRIX, COMMISSION CENTRALE D'ÉTUDES RELATIVES AU COÛT DE LA VIE. *Compte rendu des travaux au cours de l'année 1920*. Paris, 1921. (Ed.)

rance, power and light, paid supervision and sundry expenses. On the other hand, neither interest on capital invested, remuneration for management, nor reserve working capital has been included.

The results are as follows:—

### A. — *Wheat.*

Items of Cost of Production	1912-13		1920-21	
	Fcs.	%	Fcs.	%
I. <i>General Expenses:</i>				
rent, taxes, insurance, sundries . . .	186	29.14	400	400
II. <i>Manuring, fertilisers:</i>				
2 manuring for wheat . . . . .	2 × 240 = 68.60		2 900 = 227	
300 kg. super. . . . .	3 580 = 17.40	212 17.40	3 30 = 90	447 21.06
100 kg. nitrates . . . . .	1 × 26 = 26.00		1 100 = 100	
III. <i>Seeds:</i> 200 kg. selected wheat, sulphated and limed . . . . .	70	10.94	240	11.30
IV. <i>Fillage:</i>				
17 days manual labour . . . . .	17 4.25	72.25 11.21	17 15	255 12.01
17 days horse labour . . . . .	21 × 4.75	99.75 16.00	21 17	357 16.83
V. <i>Sundry articles:</i> binding cord, canes, etc . . . . .	10	1.45	50	2.36
VI. <i>Threshing</i> . . . . .	40	6.26	200	9.48
VII. <i>Cost of delivery</i> . . . . .	48.60	7.60	175	8.16
	638.95	100.00	122	100.00
	Harvesting:		Harvesting:	
23 qx.: fcs. 26.50	23 = 600.50	26 qx.: fcs. 70	26 = 1820	
700 trusses straw.	fcs. 0.20 × 700 = 140.00	700 trusses straw.	fcs. 0.80 × 700 = 560	
	Fcs. 749.50		Fcs. 2170	

1) In 1913 the cost of production of 1 hectare of wheat being 638.60 fcs., and the price realised for 1 quintal being 26.50 fcs., the latter represents 4.15 % of the outlay per hectare.

In 1921, the outlay for 1 ha. of wheat being 2122 fcs. and the quintal selling for 70 fcs., the latter represents 3.30 % of the outlay per ha.

For straw, the proportion is 3.13 in 1913 and 2.36 in 1921, per 100 trusses.

2) In 1913, the outlay per hectare was . . . . .	638.60 fcs
» 1921, » » » » » . . . . .	2,122.00 »
that is, a difference of . . . . .	1,483 40 fcs
In 1913, the quintal sold at . . . . .	26 50 fcs
» 1921, » » » » » . . . . .	70.00 »
A difference of . . . . .	43 50 »

in favour of 1921, or an increase in profit of 1,210.50 fcs. per ha. yielding 23 qx in 1913 and 26 qx in 1921

The increase in the price realised per ha. is only 81 6 % of the increase in the cost of production if the grain only be taken into account.

As regards the straw, the increase realised (prices being 20 fcs in 1913 and 50 fcs in 1921 per 100 trusses), is 14 1 % of the increase in the cost of production. Therefore the total increase in price (wheat and straw per ha) is  $81\ 6 + 14\ 1 = 95\ 7\ %$  of the increase in cost of production.

#### B. — Sugar beets

Items (of Cost of Production)	1912-13		1920-21	
	Fcs	%	Fcs	%
I. General Expenses: rent, taxes, insurance, sundries	186 00	21 08	400 00	13 74
II. Manuring & Fertilisers				
8000 kg manure				
4 for beets . . . . .	$\frac{4}{7} \times 30 \times 8 = 137\ 00$		$\frac{4}{7} \times 30 \times 514 = 834\ 00$	
100 kg. super . . . . .	4 5 85	23 40	4 30 = 120	27.30
200 kg nitrates . . . . .	2 26 20	52 40	2 100 = 200	
III Seed:				
20 kg of seed . . . . .	20 1 50	30.00	20 5 100.00	3.29
IV Cultivation				
24 days of manual labour	24 x 4 25	102 00	24 15 360.00	11 82
53 days of horse labour.	53 4 75	251 75	53 17 901.00	29 59
Plough work: and ploughing, pulling, loading . . . . .	50 + 60	110 00	—	450.00 14 77
(Total manual labour = 24 03 %).	892 55	100.00	13045.00	100 00
Yield per hectare . . . . .	29 760 kg		21 500 kg.	
Price realised . . . . .	28 65 fcs	per ton	105 00 fcs.	per ton
Gross profit . . . . .	851 00 fcs.		2257 50 fcs.	

1) In 1913, beet production costing 892.55 fcs. per ha. and the ton selling at 28.65 fcs., the latter represents 3.21 % of the cost of production per ha.

In 1921, production costing 3045 fcs. per ha., and the ton selling at 105 fcs. the latter represents 3.45 % of the cost per ha.

Appearances are in favour of 1921, but in reality the contrary is the case, owing to the poor yield of that year. With a 29760 kg. yield in 1913, the loss on beets was only 892 55 fcs — 851 fcs = 41.55 fcs, whereas in 1921, in the average yielding districts, with 21500 kg per ha., the loss was 3,045 fcs. — 2,257 50 fcs = 787.50 fcs

This proves how uncertain beet culture has been for a long time, if the returns only be considered and not the improvement in the yield of the cereals which follow this culture

2) In 1913, the returns per ha were 851 fcs., and in 1921, 2257.50 fcs., a difference of 1,406 50 fcs in favour of 1921.

The increase in price realised per ha is only 65 3 % of the increase in cost of production, this being due to the considerable decrease in yield, since the price per ton in 1921 was 3 67 times that in 1913 and the cost of production was only 3 41 more. As in the case of wheat, the final result was disastrous to the farmer, who had already in most cases lost on the previous year

### C — Potatoes

Items of Cost of Production	1913		1921	
	Fcs	%	Fcs	%
I. General Expenses rent, taxes, sund- ries . . . . .	186 00	19 20	400	12.60
II. Manuring Ferti- lisers 2000 kg. manure, 4 for potatoes 20 × 8 4 91.40 7 7 7 343 300 kg. super 3 × 5.85 = 17 55 200 » nitrates 2 26 20 52 40 206 35 21 20 2 30 = 90 200 » chloride of 2 100 = 200 737 23.00 potash. 2 22 50 45 00 2 52 = 104				
III Young plants: 1500 kg. . . . .	15 15	225 00 23 30	15 15	750 23.70
IV. Cost of cultura- tion and delivery: 36 days of manual labour 36 × 4 25 153.00 15.70 36 × 15 540 17.00 42 days of horse labour . . . . . 42 4.75 199.50 20 60 42 17 714 23.70				
		969.85 100.00		3141 100 00

Yield 12,000 kg  
At 12 fcs per 100 kg = 1440 fcs

Yield. 6000 kg.  
At 50 fcs. per 100 kg = 3000 fcs.



D) In 1913, potato production cost 969.85 fcs. per ha. and the ql. sold at 12 fr. ; the latter represented 1.24 % of the cost of production per ha

In 1921, 1 ha. cost 3 141 fcs. and the ql. sold at 50 fcs ; the latter represented 1.60 % of the cost per ha., that is, a little more than before the war.

Results therefore appear to be the same in either case, but in reality they are far from being so, owing to the wretched yield caused by drought in 1921. With 120 qx. per ha. in 1913, a gross profit of 1,440 fcs. was realised, whereas in 1921, in most cultures, 3 000 fcs. was realised. In the first case, with an outlay of only 969.85 fcs a profit of 470 15 fcs. was realised on potatoes, while in the second, there was a loss of at least 141 fcs.

2) In 1913, production cost 969.85 fcs., per ha. In 1921, it cost 3 141 fcs, a difference of 2 171 15 fcs. compared with 1921.

In 1913 the returns per ha were 1 440 fcs. In 1921, they were 3 000 fcs., a difference of 1 560 fcs in favour of 1921

The increase per ha realised is only 71 7 % of the increase in cost of production, this being due to the considerable decrease in yield caused by the drought, since the price realised per ql, was 4 1 times higher in 1921 than in 1913, and cost of production only 3 2 higher

#### D). — Milk.

Items of Cost of Production	1914	Fcs.	%
<b>I Cows:</b>			
Stable 200 days			
1 ½ trusses of hay	1 ½ 0 10 = 0.60		
40 kg of beets	40 0 18 = 0.60		
10 kg of straw	10 0 40 = 0.40		
1 kg of oil cake	1 0 20 = 0.30		
	1.80	200 days 1.80 = 360	47.7
Pasture 160 days.			
1 ha per head (included in general expenses)			
1 kg of concentrated feeds	1 0 20 kg = 0.20	3.20	160 days = 32
fencing, fertilisers (scoriae).			28
			7.5
<b>II Per cow per year:</b>			
Reserve fund for 5 years + risk of mortality 5 % (1)		40 31 = 71	9.4
Cowherd. 1 per 20 cows . . . (130 fcs. per month)		80	10.5
General Expenses: Rent, taxes, sundries		186	24.6
		754	100.0
Total cost per cow per year			
Less 1 calf . . . . . 30 fcs			
Less 10,000 kg manure at 8 fcs 80 fcs			
	110 fcs	110	
		644	
Annual production (8 l per day) . 2920 l			
Cost of production per litre of milk		644	= 0.22
		2920	

Items of Cost of Production	1921-22	Fcs.	%
<b>I. Feeds:</b>			
Stable, 200 days:			
1 ½ trusses of hay . . . . .	$1 \frac{1}{2} \times 2 = 3.00$		
40 kg. of beets . . . . .	$40 \times 0.80 = 3.20$		
10 kg. of straw . . . . .	$10 \times 0.25 = 2.50$		
1 kg. of oil-cake . . . . .	$1 \times 0.90 = 0.90$		
	9.60	200 days $\times 960 = 4920$	5.54
Pasture, 160 days:			
1 ha. per head (included in general expenses).			
1 kg. concentrated feeds . . . . .	$1 \times 0.90 \text{ kg.} = 0.90$	160 days $\times 0.90 = 144$	8.5
fencing, fertilisers (basic slag) . .		150	
<b>II. Per cow per year:</b>			
Reserve fund for 5 years + risk of mortality 5 % . . . . .		$400 \times 130 = 530$	15.3
Cowherd: 1 per 20 cows . . . . .	(130 fcs per month)	324	9.3
General expenses: Rent, taxes, sundries . . . . .			
		400	11.5
Total cost per cow per year . . . . .		3468	100.0
Less: 1 calf . . . . .	50 fcs.		
10 000 kg. manure at 20 fcs. 200 fcs.			
	250 fcs.	250	
	Total . . . . .	3218	
Cost of production per litre of milk . . . . .		3218	= 1.10
		2920	

In 1913-14, the cost of producing 1 litre of milk was 0.22 fcs.; in 1921-22, 1.10 fr., a difference of 0.88 fcs. against 1921-22.

In 1913-14, a litre of milk on the same farm sold at 0.23 fcs.; in 1921-22, it sold at 0.90 fcs., a difference of 0.67 fcs in favour of 1921-22.

The increase in the price realised is only 76.13 % of the increase in cost of production, and by selling even at the exceptionally good price of 0.90 fcs. per l., the producer loses.

To sum up, for wheat, supposing the average price realised by the last harvest to be 70 fcs. per ql., the increase in the gross returns is only 05 % of the increase of the cost of production, and this, even with an exceptionally good harvest.

For beets used in sugar production etc., the increase in receipts is only 65 % of that of the expenses, per ha, owing to the bad harvest.

For potatoes, which also suffered from the drought the increase in receipts is only 71.7 % of that of expenses.

The increase in the price realised for milk is only 76 % of that of the cost of production, under fairly good economic conditions, and exceptionally favourable conditions for the sale direct to the consumer.

G. A. B.

## AGRICULTURAL INDUSTRIES

765 - **Copper in Light Wines.** — PRANDI, O., in *Le Stazioni sperimentali agrarie italiane*, Vol. LXIV, Pts. 11-12, pp. 469-473. Modène, 1921.

It has now been definitely proved that copper (from fungicide sprays) is eliminated almost entirely during grape fermentation. The reduction of sulphate in sulphur is the result of a diastase produced by the ferment. As fermentation is incomplete in the sweet wines the author undertook to determine the amount of copper content in light white wines such as the muscat. An analysis of 25 samples was made in 1920, a year in which fungicides were largely employed and the results obtained are shown in the following Table :

*Alcohol and Copper in Light White Wines.*

Name and origin	Alcohol % in volume	Extract % grm.	Copper % grm.
Moscat Alba . . . . .	1.2	232.80	0.0160
» » . . . . .	4.2	187.52	0.0085
» Barbaresco . . . . .	3.4	192.60	0.0098
» » . . . . .	5.9	143.50	0.0045
» Castiglione Tinella . . . . .	1.9	202.30	0.0110
» » » . . . . .	0.5	180.10	0.0155
» Canelli . . . . .	2.8	194.40	0.0130
» » . . . . .	3.8	208.30	0.0155

The quantity of copper is therefore inverse to that of alcohol. In the wines that are very sweet and consequently very poor in alcohol, the copper content is noticeable, up to as much as 0.160 gm. per litre.

On two occasions when restarting the fermentation of the Albe Muscat which has a high copper content and scarcely 1.2 % of alcohol, half the copper disappeared and the alcohol content was quadrupled. There is therefore no doubt that the high copper content is due to incomplete fermentation. It is, however, impossible under ordinary circumstances to have recourse to renewed fermentation, as certain types of wine, should be allowed to retain their sweetness. The author has for this reason attempted to bring about a reduction of the copper by using pure potassium sulphide ; for this purpose the commercial product, which is a polysulphide is unsuitable.

According to the results obtained, and noting that the presence of copper at the rate of 9 mgm. per litre affects the taste, the author makes the following suggestions : if at the first sampling or as a result of the well-known steel blade test, an excess of copper is observed, the addition of an excess of pure potassium sulphide ( $K_2S$ ,  $5H_2O$ ) is advised at the rate, for example, of 15 to 20 gm. per hectolitre, if crystallised, and of 8 to 11 gm.

of liquid. About a week later, 6 to 8 gm. per hectolitre of metabisulphite of potassium should be added to eliminate the sulphuric acid; and the wine left for one week and then filtered. This treatment has no effect on the characteristic Muscat aroma.

Any excessive diminution in acidity as a result of the precipitation of acid tartrate of potash, may be rectified by adding tartaric acid.

F. D.

766 - Administration of the Economic Poison Law in California. — See No. 679 of this Review.

767 - Distillation Experiments in the Preparation of Otto of Roses (1). — I. GADRE, S. T. (Industrial Chemist to the Government of the United Provinces, India) and MUKEJI B. C. (Chief Chemist, Office of Metallurgical Inspector Jamshedpur), Rose Otto from Rose flowers (*Rosa Damascena*) of the United Provinces, *Journal of Indian Industries and Labour*, Vol II, Pt I, pp 86-102 + Tables. Calcutta, Feb. 1922. — II. Notes on the Preparation of Otto of Rose and Advantages of Bulgarian Method, *The Cyprus Agricultural Journal*, Vol XVII, Pt. I, pp. 7-8. Nicosia, Jan 1922.

I. — Report of comparative experiments made at the Government Technical Laboratory, Cawnpore, India, with various types of stills. It is worth noting that flowers sent for distillation can apparently be stocked undamaged for 3 or 4 days after plucking, if a preservative like common salt be used.

The maximum atmospheric temperature during the period of the experiments was about 108° F and the minimum 78.5° F; the average relative humidity being 35.

Genuine samples of Bulgarian otto of rose and virgin otto of rose from Anatolia were also obtained for comparison and the constants resulting from the different products are compared with some known values of ottos from other sources. The optimum yield of otto obtainable from the Cawnpore *R. damascena* was found to be much lower than that in roses from Bulgaria etc.

As regards the evaluation of rose water in terms of otto the author gives in detail the method to be adopted for evaluation purposes following the lines of determination of the iodine absorption.

The tabulated results obtained with 11 samples of once-distilled rose water from the Indian Essential Oils Co. Cawnpore, prepared by distillation with steam at varying pressures, and the use of native (DEG) and Bulgarian stills indicate that the variation in pressure has apparently no influence on the total yield, nor on the quality of the otto. According to these results, the native DEG still has given practically similar results to the Bulgarian type.

It has been ascertained that live steam is unsuitable for otto preparation. A steam-jacketted still is however recommended as the best possible, although its practicability on rose fields and with certain grades of distillers is considered questionable.

(1) See R. Sept. 1921. No. 947. (Ed.)

The fourth type of still tested which is both portable and easily worked, was a modification of the DEG with a separate top containing a fairly wide leading tube with which a worm condenser could be connected when the still was at work.

II (1). — A detailed description of the Bulgarian system of distillation indicates the advantages of this method. A copper still, with a capacity of about 110 litres, is employed, with a mushroom-shaped head connected by a straight inclined tube with a worm condenser placed in a tub of water, the ratio being 10 kg. of flowers to 75 litres of water. An open fire is used and 10 litres of water are distilled after which the liquid in the still late is allowed to cool is separated from the flowers, made up to 75 l. again with cold water and fresh flowers added. This is repeated until up to 40 l. has been collected and afterwards distilled, and the first 5 l. set aside to allow the oil to separate. The remaining 35 l. are utilised for distilling a further quantity of flowers.

Whole flowers are generally used, the petals seldom being treated separately. The average yield is 1 kg. per 2000 kg. flowers.

A comparison is made with the steam still methods adopted in France and it appears that when the distillery is conveniently situated as regards the cultivated area, results equally satisfactory are obtained.

It appears that the best results both as regards quality and yield can be secured when :—

- 1) the roses are gathered early in the morning and the distillation of whole flowers is carried out the same day,
- 2) steam stills are employed in preference to open fires,
- 3) the head and neck of the still are very short and wide.

Speaking generally the Bulgarian method is recommended for use whenever possible. M. L. Y.

768 - Cost of Milk Production in Maryland, U. S. A. (1). — *The Creamery and Milk Plant, Monthly*, Vol. X, No. 6, pp. 56 and 72; No. 7, pp. 25-27. Chicago 1921.

I. — In 84 farms in northern Maryland, inspected in 1921 by the United States Department of Agriculture in co-operation with the University of Maryland, the average sale price is 33.2 cents per gallon, \$3.86 per 100 lb. and \$213.13 per c w per year. At an average price of 34.2 cents per gallon, 48 of the farmers (51 %), failed to make a profit, with all feed and labour charges at full current rates.

The average number of cows on the farms surveyed was 18.2; the annual production of milk per cow varied from less than 4000 lb. to over 8000 lb. with an average for all cows of 6074 lb. Practically all the milk in question was shipped either to Washington or to Baltimore.

Of the total cost of production, about one-half (\$121.38 per cow) was for feed 56.6 % of this being for farm produce.

Grain feed amounted to 2259 lb. per cow per year; 512 lb. of this being

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PRODUCTS

(1) Notes furnished by the Imperial Institute, London. (Ed.)

(2) See R. April 1922, No. 370. (Ed.)

grown on the farm. Hay feed amounted to 1793 lb., practically all home-grown. Man labour per cow totalled 291 hours; horse labour 29 hours.

II. — According to the investigations made by the Milk Producers Dairy Tariff Committee the cost of producing 100 lb. milk in various parts of the United States is as follows:—

New England . . . . .	\$	2.85
New York . . . . .	"	2.56
Philadelphia . . . . .	"	3.10
Baltimore . . . . .	"	3.12
Ohio . . . . .	"	2.86
Chicago . . . . .	"	2.53
California . . . . .	"	2.60
Average . . . . .	\$	2.80

These results were obtained as an average of costs reported by different sections. The method of determination is not identical. The New York cost is based upon the WARREN formula. For 100 lb. milk, the following are the requirements (in lb): grain 33.29 + hay 43.3 + other dry forage, 10.8 + silage 92.2 + other succulents 8.3, and labour 3.02 hours; the total representing 79 % of net cost for general expenses.

F. D.

769 — Dairy Inspection in California. — See No. 679 of this Review

770 — Investigation on Lactose Ferments in Cream which has a "Yeasty" Flavour. — HAMMER, B W and CORDS, W A (Iowa Agricultural Experiment Station) in *The Creamery and Milk Plant Monthly*, Vol. X, No. 6, pp. 44-45. Chicago, 1921.

When cream is sent to the butteries without first passing through the refrigerator, it sometimes undergoes fermentation during the journey, the nature of which fermentation depends chiefly on the micro-organisms it contains and the temperature of the surroundings. One of the most frequent of these fermentations in summer is that which produces "yeasty" or "foamy" cream. This cream has the characteristic odour and flavour of yeast, and these pass into the butter; it also becomes frothy, and a part of it escapes from the jars.

The authors proposed to find out whether (1) this fermentation is always caused by the same micro-organism; (2) the micro-organisms which cause it are only found in cream which has a yeasty task, or likewise pervade fresh cream, milk, dairy utensils etc. They obtained the following results:

Lactose ferments were isolated from 21 samples of cream with a yeasty flavour, collected in five different States of the Union; from 8 out of 9 samples of second quality cream collected in Iowa; from 12 out of 72 samples of sour cream with a normal flavour collected in Iowa; from 3 samples of milk (2 from Iowa and 1 from Denmark); and from a sample of "matzum".

A comparative examination of the morphological, cultural and bio-

chemical characteristics of these 45 lactose ferments was made and led the authors to divide them into two types: *A*, much more frequent, larger and more rapid than the other, oval or elliptic, with an optimum temperature of 37° C.; capable of fermenting various carbohydrates; *B*, a true gelatine liquefier (whereas *A* is rarely so). A comparison of these micro-organisms with those described up to the present, showed that they do not correspond exactly with any of the latter; the authors therefore propose to call them respectively *Torula cremoris* and *T. sphaerica*.

Lactose ferments similar to those which cause the yeasty flavour of cream are much more common than might be supposed from the quantities of cream which undergo this change. The ordinary conditions of cream therefore do not favour the development of this change.

Besides the presence of the ferment which causes the change and the temperature which favours its development, there are other factors which cause the yeasty flavour and foam on cream; they are: the viscosity or thickening due to curdling and sufficient to prevent the gases set free from escaping rapidly; the reduced solubility of the gases when the cream is exposed to very high temperatures; the closing of the tin which contains it and shaking. Lactose ferments are widespread and it is useless to think of suppressing them in cream in order to prevent fermentation. The best the small producer can do at present is to keep the cream at a low temperature; in the case of large quantities, recourse must be had to pasteurization.

F. D.

771 - **Experimental Cheese-Making Institute at Lodi.** — *Annali dell'Istituto sperimentale di Caseificio di Lodi*, Vol. 1, No. 1, pp. 44. Lodi, 1922.

By a Decree of 10<sup>th</sup> November 1919, the Royal Experimental Cheese-making Station of Lodi, was transformed into the "Autonomous Syndicate of the Experimental Cheese-making Institute". The differences between these two Institutions are, from the scientific point of view, a deeper and wider field for experimental research; and from the administrative point of view, autonomous control with a Board of Directors as the responsible head.

The Commissariat of Food Supplies granted a sum of 1 500 000 lire, raised from the "Obligatory Consortium for the Control of the Butter Trade in Milan." for the initial expenses of this Institute.

It has been deemed necessary to acquire an agricultural property, on which research work will be carried out on the alimentary and physiological factors which influence milk production, with a view to explaining phenomena of all kinds connected with dairy products.

The Institute has therefore two fields of action: experimental research, and making known the results of new investigations and those already made, in order to extend the national milk industry.

The subjects already treated or under investigation include: study of the critical temperature at which butter and its substitutes become soluble in acetic acid; chemical and bacteriological study of "hay-silage";

research on the bacteria in butter in the district of Lodi (1); research on the bacteria in butter kept at a low temperature ; mechanical milking apparatus considered from the chemical, bacteriological, technical and economic point of view , technological study of the manufacture of Asiago cheese ; preliminary experiments for improving the manufacture of Parmesan Cheese.

F. D.

772 - **A Good Type of Mixed Cheese : the " Vittoria " of the Andria School of Agriculture (Province of Bari).** — PANTANELLI, F (Director of the Agricultural Station of Bari) and VIVARELLI, L (Director of the Agricultural School of Andria), *Il formaggio misto Vittoria, La propaganda a ricola*, Vol XIII, Nos 22 23, pp 209-314, figs 9, No 24. pp 232 236 Bari, Nov and Dec 1921

For several years the Andria School of Agriculture has been making and marketing successfully a cheese made from mixed milks. This is a special device of the School for rendering butter-making possible in Apulia, by using buttermilk in cheese-making. Skimmed cow's milk is mixed with whole ewe's milk for the preparation of the so-called " Vittoria " cheese.  $\frac{1}{2}$  to  $\frac{1}{3}$  of ewe's milk is added to 1 part of skimmed milk, one hectolitre of the mixture yields 2 to 3 kg of excellent butter and 12 to 15 kg of cheese. Each cheese weighs about 5 kg and requires 40 litres of skimmed cow's milk and 19 ltrs of whole ewe's milk. This cheese which is similar to Parmesan, may be used after 6 to 7 months, but does not fully ripen until after a year.

The author describes the process in detail filtration, heating at 36°-38°c, the addition of rennet, breaking the curd, boiling the coagulum, filling the moulds, pressing, salting, ripening.

The percentage content of " Vittoria " Cheese, 6 months and 1 year after manufacture from  $\frac{2}{3}$  cow's skimmed milk and  $\frac{1}{3}$  ewe's milk was as follows: water 43.27 and 30.6, fats 12.52 and 19.08, total nitrogen 4.023 and 3.504, protein nitrogen 3.485 and 3.140, soluble nitrogenous products 0.538 and 0.364, crude proteins 25.14 and 31.90, albuminoids 21.99 and 19.63, free acids (calculated as lactic acid) 0.839 and 2.80, soluble extract (in the 6 months old cheese) 26.71, ash 2.425 and 6.10, and sodium chloride 6.579 and 4.948.

In nutritive and digestible qualities the " Vittoria " is superior to the Roman " pecorino " and " caciocavallo ", and it may be used both for the table and as grated cheese.

F. D.

773 - **Bacteria in Butter** (2). — DALLA TORRE, G in *Annali dell'Istituto sperimentale di Casalecchio in Lodi*, Vol I, No. 2, pp 55-70, Lodi, April 1922.

In order that the improved methods of butter making may be properly followed, the bacterial flora of butter and the various factors which influence them must be known. With this object the author has carried out at the Experimental Cheesemaking Institute at Lodi, a series of experiments with cultures or 1) agar-agar-lactose, 2) gelatine-serum, 3) agar-agar-serum-peptone, and has noted the following facts

(1) See No 773 of this *Review* (Ed)

(2) See *R* May June, 1922, No 639 (Ed)



The number of germs contained in 1 gm. of butter varies from a minimum of 36 200 to a maximum of 7 360 000. In addition to the usual factors which affect the bacterial content of food-products, these great differences are due to the different times at which the butter is made, to the various temperatures, at which the milk has been kept and to the length of time it has been left in the receptacles before skimming.

The majority of the microbes observed were always lactic bacteria (29 000 to 7 000 000 per gram of butter); among these, the coccus occurred most frequently and was the most numerous. *Coli aerogenes* were frequently found, but were rarely plentiful. Gelatine-liquefying bacteria were often observed, and sometimes in large numbers. *Saccharomyces* and *torula* varied from 1 000 to 120 000 per gram; *Oidium lactis*, due to long standing in the receptacles for the final skimming, were often noticed and 200 to 20 000 of these germs per gram of butter were counted. In several samples, the spores of anaerobic bacteria were noticed, but generally in small numbers.

F. D.

774 - **Dairy Products Investigation. Projects Carried on by the Agricultural Experiment Stations in the United States.** — POTTS, R. C. in *Journal of Dairy Science* Vol. IV, No. 5, pp. 416-425 Baltimore, 1921.

The Office of Experiment Stations of the United States Department of Agriculture has compiled a booklet of 225 pages setting out the dairy products activities now in progress. The following list has been extracted and indicates the various phases in this industry to which special attention is given, and this should be useful to experts and suggests opportunities for coordination of work and co-operation among workers :—

LIST OF STATE AGRICULTURAL EXPERIMENT STATION DAIRY PRODUCTS PROJECTS.

*Chemical studies of dairy products* (1).

1. Study of the properties of pure casein, New York State.
2. Study of the carbonic acid in milk (Ditto).
3. Study of the chemistry of butterfat and the effect of food in modifying its chemical and physical character (Massachusetts).

4. Method for detection of abnormal milk (New York State).

5. Method for determination of keeping quality of milk (Ditto).

*Nutrition Studies.*

1. Role of dairy products in practical nutrition (Oklahoma).
2. Food value of various milks for infants and invalids (Maryland).
3. Nutritive value of milk for children and animals (Vermont).
4. Minimum quantity of butterfat necessary to produce normal development in young growing animals (Oregon).

*Bacteriological studies* (2).

1. Investigations with raw and manufactured dairy products (Michigan).

(1) See No. 770 of this Review. (Ed.)

(2) See No. 773 of this Review. (Ed.)

2. Influence of barn conditions on the germ content of milk (Illinois).
  3. Species of bacteria found in dairy utensils (Cornell, N. Y.).
  4. Important factors in the production of sanitary milk and means and methods of milk testing (New York State).
  5. Bacteriological examinations of certified milk (California).
  6. Study of the true accuracy of bacterial counts as made from milk (New York State).
  7. Determination of the bacterial content of milk by a rapid method (little plate) (Wisconsin).
  8. Bacteria content of milk from milking to cooling (S. Carolina).
  9. Studies on cooling of milk in relation to its bacterial quality (New York State).
  10. High acid organisms found in American milk (Iowa).
  11. Acid production and the rate of growth of the lactic acid organisms in the sowing of milk (New York State).
  12. Studies on bacterial flavour and odour of milk.
  13. Study of the *Torula* forms causing yeasty fermentation in cream (Iowa).
  14. Effect of preservatives on the bacteria in milk (Pennsylvania).
  15. Use of available chlorine as a germicide in milk and milk products (Arkansas).
  16. Bacteriology of butter (Oklahoma).
  17. Chemical and bacteriological study of the keeping qualities of butter (Indiana).
  18. Study of the development of moulds on butter (California).
  19. Study of the types of organisms present and multiplying in cottage cheese (Idaho).
  20. Studies on the relation between the bacterial flora of good quality cheese and of good quality milk (New York State).
  21. Studies of the compounds in cheese and the changes which occur under the influence of certain classes of bacteria (Ditto).
  22. Chemical and bacteriological studies of ice cream (Indiana).
- Studies of butter and butter making*
1. Influence of acidity of cream in flavour and keeping qualities of butter (Iowa).
  2. Neutralisation of acidity of cream for butter making (Oregon).
  3. Effect of neutralisation on the quantity of butter (N. Y. Cornell).
  4. Chemistry of churning (1) (Missouri).
  5. Causes of difficult churning (Washington).
  6. Factors influencing quality of butter (Oklahoma).
  7. Study of Californian butter at the Davis and San Francisco markets (California).
  8. Comparison of creamery and market weights of butter (Wisconsin).
  9. Study of dairy records (Cornell N. Y.).
  10. Constructional improvements of creameries (N. Carolina).

(1) See No 773 of this Review (Id)

11. Keeping qualities of butter (Michigan).
12. Keeping qualities of butter in storage as affected by churning methods.
13. Chemical and bacteriological study of the keeping qualities of butter (Indiana).
14. Study of mould development on butter (California).
15. Scoring contests of commercial butter (Idaho).
16. Bacteriology of butter (Oklahoma)
- Studies of cheese and cheese-making* (1).
1. Mountain cheese work (North Carolina).
2. Making cheese (North Carolina).
3. Cheese investigations (Wisconsin).
4. A study of the manufacture of cheese and whey (California).
5. Studies of the compounds in cheese and their changes under the influence of certain classes of bacteria (New York State).
6. Factors concerned in the coagulation of milk by heat (Wisconsin).
7. Yield of cheese from milk high and low in fat (Wisconsin).
8. Pasteurization of milk for cheese making (New York Cornell).
9. The effect of clarifying milk for making Cheddar cheese (New York Cornell).
10. Studies in cheese making. Effect of temperature of cooking on texture of cheese ; effect of amount of rennet or pepsin on rapidity of curing cheese ; the possibility of curing cheese in Oklahoma factories ; controlling factors in proper handling and marketing of cheese in Oklahoma (Oklahoma).
11. The effect of separating temperatures on the loss of fat in separated whey (Oregon).
12. A study of the control of mould development in cheese-curing rooms (California).
13. The use of *Bacillus bulgaricus* starter for controlling gassy milk in the manufacture of Cheddar cheese (California).
14. The effect of washing curd on the yield and quality of Cheddar cheese (N. Y. Cornell).

(1) Cf. SAMMIS, J. L., Cottage Cheese and Buttermilk Cheese : Their Manufacture and Sale (*Wisconsin Agric. Expt. Stn. Bull.* 315, pp. 16, figs. 8. Madison, 1920).

FLEMMERGER, H. B., Cold storage of cottage and other soft curd cheeses, *Vermont Agric. Stn. Bull.* 213, pp. 2. Burlington, 1910

BAIRD, H. S., Neuchâtel Cheese, *California Agric. Expt. Stn. Circular* 207, pp. 4, figs. 2, Berkely 1919. -- Brief rules for the use of home manufacturers. It is stated that although goats' milk is preferable, a good quality Neuchâtel cheese is obtainable with cow's milk. Seeing that the outlay is small, this industry should prove profitable to cowkeepers who can thus utilise the unsold milk during the productive season.

MORLEY, I. W., Cheese Making under Missouri Conditions, *University of Missouri, Agric. College, Agric. Expt. Stn. Bull.* 164, pp. 39-40. Columbia, 1910. Study of the ripening process in cheese. An experiment is made by ripening in carbon dioxide, moulds are thus prevented. The author considers that this method should serve to solve the problem of keeping small cheeses. (Ed.)

15. The use of pepsin as a substitute for rennet in the manufacture of California (granular) and Cheddar cheese (California).
16. Studies in the manufacture of Swiss cheese in vats. (Oregon).
17. The manufacture of Camembert, Swiss, and albumin cheeses (N. Y. Cornell).
18. Cheese making (Cottage, Neufchatel, whey, Romano, etc.).  
A study of the practice of cheese making with special reference to the manufacture of foreign cheese (Vermont).
19. Relation of moisture and acidity to keeping quality of Neufchatel and cream cheeses (N. Y. Cornell).
20. The manufacture of cottage cheese from a mixture of skim milk using *Bacillus bulgaricus* starter for curdling the milk (California).
21. The manufacture of a skim milk cheese that will keep (S. Dakota).  
*Cream production studies.*
  1. A study of some factors affecting the texture of the cream (California).
  2. Losses in farm skimming of cream (North Carolina).
  3. Factors affecting the efficiency of hand separators and causes of variation in cream tests (Nebraska).
  4. A study of the efficiency of the various cream cooling tanks (Nebraska).
  5. Cream routes (North Carolina).
  6. An investigation regarding the whipping of cream (Washington).  
*Ice cream studies.*
    1. Ice cream investigations (Kansas).
    2. Studies in ice cream making (Oklahoma).
    3. Commercial ice cream making (Oklahoma).
    4. Testing ice cream for butter fat. A comparison of various acids as to time required, ease of manipulation, character and accuracy of test; comparison of different ingredients upon character of test, such as sugar, gelatin, gum, tragacanth, and ice cream powder, fruits, eggs, and color material; influence of method of obtaining samples, time cream has been packed and manner of packing; comparison of results with cream and milk bottles; effect of emulsifying and homogenizing upon ease with which tests may be made (Oklahoma).
    5. Chemical and bacteriological studies of ice cream (Indiana).
    6. A study of the factors affecting swell in ice cream (California).
    7. Factors affecting the formation of ice crystals in ice cream (N. Y. Cornell).
    8. Fillers in the manufacture of ice cream (Washington).  
*Studies of milk secretion, composition and supply.*
      1. An investigation of physiological and chemical changes taking place within the mammary gland during secretion (Maryland).
      2. Certain problems relating to the biochemistry of milk formation in the udder (New York State).
      3. Milk secretion studies, using condemned tubercular cattle. The study of the source of milk solids (Vermont).

4. Synthetic capacity of the mammary gland (Wisconsin).
5. Feeding galactose to dairy cattle (Delaware).
6. The influence of barley on the milk secretion of cows (California) (1).
7. Investigations into causes of variation in milk and fat production. Effect of individuality of cows upon milk and fat yields. Influence of alimentary carbohydrates on the yield and composition of milk. Effect of proteins from restricted sources on the yield and composition of milk (Iowa) (2).
8. Factors influencing or affecting the chemical and physical properties of milk (Missouri).
9. Analysis of milk records. To determine the age changes and the duration between total solids-not-fat and milk production, per cent fat, and butter fat (Maine).
10. Factors influencing the composition of milk; the influence of the plane of nutrition of the cow (Missouri).
11. A study of the composition of milk and fat — as affected by feeds, from different breeds of cows, and with reference to the natural quantitative relationship existing between the various constituents of milk (Ohio).
12. Study of the chemistry of butter fat and the effect of food in modifying its chemical and physical character (Massachusetts).
13. The effect of peanut meal when fed to dairy cows on the qualities of the butter fat, and methods by which this feed may be fed without undesirable effects (Georgia).
14. Study of carbonic acid in milk (New York State).
15. Carbonic acid in milk under various conditions after being drawn from the udder, and carbonic acid content as a basis for distinguishing between heated and unheated milk (New York State).
16. Carbonic acid and carbonates in the udder (New York State) (3).
17. Acidity of fresh milk (N. Y. Cornell).
18. Conditions affecting hydrogen-ion concentration in milk (New York State).

(1) WOLL, F. W., The Influence of Barley on the Milk Secretion of Cows, *Californian Agr. Exp. Station, Bulletin* 305, pp. 325-331. Berkeley, 1910.

Complete data on: Quantity and nature of feeds, live weight, amount of milk and butter, obtained: 1) from a cow (half-breed Holstein), for 3 milkings, the only grain fed being barley, and for 2 milkings, when a mixture of grains was fed; 2) from a pure bred Jersey for 4 milkings, for each milking, barley the only grain fed; 3) from another pure bred Jersey for 2 milkings, when a mixture of grain was used and 1 milking using barley only. The results are compared with those for 15 other cows fed for short periods (usually 5 weeks) on barley with intervening periods of mixed grain.

As a rule, the barley feed was followed by the highest milk production, but this should not be attributed to the particular qualities of the barley, but rather to the fact that cows often consume a larger amount of barley than of the mixed grain. Consequently the idea held by certain cowkeepers that barley tends to dry the mucous membrane is unfounded.

(2) See No. 715 of this *Review*. (Ed.)

(3) See *R. Dec.* 1921, No. 1282. (Ed.)

19. Acid production and the rate of growth of the lactic acid organism in the souring of milk (New York State).

20. Investigation in the eradication of onion flavors from milk (North Carolina).

21. The enzymes of milk and their relation to abnormal flavors (Montana).

22. The toxicity of milk.

23. Effect of diseases in the cow on milk (Michigan).

24. Study of city milk supply (N. Y. Cornell).

25. Studies on method of controlling and standardising the quality of market milk (New York State).

26. Study in the quality of milk (Oregon).

27. Tests for pasteurised milk (Wisconsin).

28. Studies of minor factors in market milk distribution (Michigan).

29. A study of the milk and cream supply furnished to the University Farm Creamery, with the object of working out a system of grading and paying for quality (California).

30. The marketing of dairy products, in Oklahoma. To ascertain general prices of butter fat, of milk and cream in all sections of the State at four periods of the year. The kind of market available; amount of butter fat, milk or cream offered for sale at centres in all sections of the State, methods of marketing, and form in which butter fat is marketed; frequency of market and the factors determining prices (Oklahoma).

31. Shipments of dairy products in New York State (N. Y. Cornell).

32. The production, handling and marketing of milk and the making of butter under tropical conditions. Dairying in the tropics (Porto Rico).

*Studies in milk testing* (1).

1. Official dairy testing (N. Dakota, Washington).

2. Advanced registry testing (Virginia).

3. Comparison of fat tests made by cow testing associations and local creamery (N. Y. Cornell).

4. Composite versus one day testing of milk samples (North Carolina).

*Studies of cost of milk production and accounting* (2).

(1) Cf. E. C. WOORHIES, Cow testing Associations in California, *California University Agr. Exp. Station, Bulletin* 314, pp. 157-193, figs. 10. Manhattan, 1900.

FITCH, J. B. and ATKINSON F. W., Rules for Testing Dairy Cows for advanced Registration, *Kansas Agric. Exp. Stat., Circular* 82, pp. 12, fig. 1. Manhattan, 1920.

(2) See *Review* Jan. 1920, No. 115; *Review* April 1922, No. 490. The following references are available on this subject: PEARSON, F. A., The Seasonal Cost of Milk Production, *Illinois Agr. Exp. Stat. Bulletin* 224, pp. 3-18, figs. 1. Urbana, 1919. Observations were made, monthly as to the variation in the net cost of milk (sold crude on the Chicago market) for 18 stations. During the period, viz. the years ending June 30, 1915 and June 30, 1916, the total stock is estimated as follows: 107 cows, 19 bulls, 234 calves, with a sale of 3047 lb. of milk. Two bookkeeping systems are adopted: one based on the stock as a whole, the other on the cows only (including the necessary bulls). In the latter system, the cows are graded in accordance with the value of the calf at birth; the cost of calving is debited to the cow. In the calculations, the interest is distributed uniformly for

1. Cost of milk production (Connecticut (Storrs), N. Dakota Ohio) (1).
2. Cost of milk production in Nebraska (Nebraska).

the whole year, but the remainder of the entries etc., for items impossible to estimate each month, were distributed according to the quantity of milk produced. During the winter season (November to April), the milk obtained amounted to 57 % of the total. In the following table a résumé of the more important figures is given. The author explains how sale cost can be determined on these figures; the decrease in return from pasture is also discussed.

*Variation, during the six months period (summer and winter) of amount of manual labour, and feeds necessary to obtain 100 lb of milk and the total net returns in relation to the net return at 100*

Time	For all the bulls						For bulls and cows					
	Manual labour	Grain	Hay	Other fodder	Silage	% Net cost	Manual labour	Grain	Hay	Other fodder	Silage	% net cost
	hours	lb	lb	lb	lb	lb	hours	lb	lb	lb	lb	lb
November-April )	1.14	53.9	67.8	60.5	233	106	5.33	43.9	53	42.1	183	86.3
May-October. . .	1.26	22.8	18.8	6.1	149	81	4.75	17.6	14.2	4.3	115	61.9
Whole year . . .	5.74	40.7	46.6	37.4	197	97.9	5.06	32.4	36.4	25.9	154	77.8

Cost of Producing Dairy Products. *Minnesota Agric Exp Sta Report* 1919, pp 121 St. Paul 1920. According to figures furnished by 6 Control Societies for milk production (1635 cows giving an average production of 3000 lb of milk and 114 lb of butter) it may be concluded that for 100 lb. of milk the following is required: 17.3 lb. grain + 41.5 coarse feed + 89 lb. silage and 60 days on pasture

APP, E. A., Study of the Cost of Milk Production, *New Jersey, Agr. Exp. Stat. Report*, 1919, p. 299. New Brunswick, 1920. According to the cost in 1918, the upkeep cost for 1 cow per year is estimated at \$27.60, the returns amount to 7.21 cents per quart.

(2) How to determine the Cost of Milk. *Monthly Bulletin, Ohio Agr. Exp. Station*, Vol. III, No. 12, pp 363-366; Vol. IV, No. 1, pp. 17-21, figs 1, 1919. Book-keeping model for use of milch cow stock raiser, followed by a summary of the cost price of milk, collected from 33 stations in Ohio. All the expenses, except for feeds and manual labour, are quoted in % of the value of the cow, considered as of ordinary, not pure breed. The total percentage amounts to 27.8 %, and when added to the cost of horse labour per cow (for milk transport etc.), it may be regarded as the equivalent of the value of the meat and 9 tons of farmyard manure obtained through the cow annually. As a rule, a cow remains 187 days out of the year in the meadow, but during this period, receives supplementary feeds. The cost price of equal weight in milk is estimated on the assumption that the cow is fed exclusively in the meadow for 5 months, beginning towards mid May and only given other feeds during the other 7 months.

From the figures obtained from 33 Stations in Ohio, it appears that during winter the outgoings, without equivalent returns for the production of 100 lb. of milk are: 44 lb. grain

- 3 Procuring data relative to the cost of producing market milk (Michigan) (1)
- 4 Cost of milk production and dairy farm organisation (Washington)
- 5 Cost of milk from forced versus average dairy condition cows (Maryland)
- 6 Records of production cost of feeding and cost of milk production in tests of advanced registry of dairy cows To secure records of production of registered dairy cows in Oklahoma to secure feed records and methods of feeding dairy cows when under official test, to determine the cost of feeding test cows in Oklahoma to determine cost of production of milk in tests of advanced registry to owners or breeders of dairy cows (Oklahoma)
- 7 Cost of producing dairy products (Minnesota)
- 8 Method and cost of distributing milk with special reference to Oakland Alameda and Berkeley California
- 9 A study of the cost of the production of milk for the city supply and of butter fat for the creamery (Illinois)
- 10 Dairy farm organisation and cost of milk production (Washington)

DAIRY PRODUCTS ACTIVITIES OF THE DAIRY MARKETING DIVISION OF THE  
BUREAU OF MARKETS OF THE UNITED STATES DEPARTMENT OF  
AGRICULTURE (For the year 1919-1920 and 1921)

*Investigational activities*

*Methods and cost of marketing dairy products*

- 1 Methods of butter marketing by wholesalers and jobbers
- 2 Methods of cheese marketing by wholesalers and jobbers
- 3 Methods and costs of supplying cities with market milk and cream
- 4 Methods of marketing cottage cheese by manufacturers and retailers

15 lb silage + 13 lb hay + 51 lb forage + 1 lb straw etc + 1 hour labour When  
in pasture 136 days for pasture 3 hours labour

GRADY R J and BUGBY W O Dairy Production in Ohio, Ohio 1st Expt Sta Bull  
334 pp 5, 541 figs 3 Wooster 1919 Continuation of preceding studies with the  
same 3 stations including 81 accounts per year (1919-19) Results show that during winter  
the average quantity of feed and labour required each year per cow is as follows (in lb)  
grain 66 lb + silage 2255 lb hay 663 lb + forage 103 + green forage 220 + pasture  
187 days manual labour 162 hours horse labour 68 hours The feeds represent 34 %  
net cost of milk the labour 8 %, other expenses 18 % The average cost apart from feeds  
and labour estimated regarding the value of the cows as equal to \$69.70 is rent of land  
and buildings 81 equipment 3 interest, insurance taxes, etc 63, mount rate 25, depre-  
ciation 35 etc 43 total 77 % In Bull 501, U S Dept of Agr using the same method,  
an estimated total of 79 % is given

The manure obtained is stated as being, on an average per cow annually - nitrogenous



5. Plan of organisation and functions performed by producers' dairy marketing organisations.

*Market grades and standards for dairy products.*

1. Market grades and standards for creamery butter.
2. Market grades and standards for American (Cheddar) cheese.
3. Market grades and standards for cream.
4. Market grades and standards for market milk.
5. Market grades and standards for Swiss and brick cheese.

RESEARCH ACTIVITIES OF THE DAIRY DIVISION OF THE BUREAU OF ANIMAL INDUSTRY OF THE UNITED STATES DEPARTMENT OF AGRICULTURE (For the year 1919-20 and 1921).

*Dairy research laboratory.*

1. Bacteria concerned in the ripening of Swiss cheese.
2. Utilisation of lactose by fermentation.
3. Physiology, taxonomy and origin of the streptococci occurring in milk.
4. Manufacture and ripening of Roquefort cheese.
5. Manufacture and ripening of Camembert cheese.
6. Factors influencing texture of ice cream.
7. Utilisation of whey for feeding purposes.
8. The precursors in the blood of milk proteins.
9. Bacteria concerned in the deterioration of condensed milk.
10. Influence of calcium and phosphorus deficiency on milk yield.
11. Factors influencing viscosity of condensed milk.
12. Methods of improving hand separator cream.
13. The manufacture and curing of the hard Italian cheeses.
14. The utilisation of the albumen of whey.
15. Bacteria surviving sterilisation in evaporated milk.
16. Factors influencing the coagulation of evaporated milk in sterilisation.

substances 47.1 lb., phosphates 19.5 lb., potash 35.6 lb. The mean annual production of milk was 2,000 lb., butter 115.8 lb.

The return for meat, manure, and milk amounted to \$124.62 per cow per annum while the outgoings came to \$18.55. The net cost was \$1.30 per 100 lb. or \$2.87 per quintal not including expenses of management. In 1918 these were estimated at \$1.75 to 2.01 per 100 lb. The cost of milk may vary from \$2.76 to 4.5 per 100 lb.

(1) RIDDEL, F. T., *Michigan A. E. Exp. Station Quarterly Bull.*, Vol. 3, No. 2, pp. 45-46. East Lansing, 1920. For production of 100 lb. of milk, the following requirements are considered necessary (taken from a study of the net cost of milk in 225 stations (3370 cows) in 9 Counties in Michigan): — grain 11 lb. + purchased feeds 15.6 lb. + hay 31.1 lb.; other dry forage 15.9 lb.; other succulent forage (purchased) 7 lb.; maize silage 114.5 lb. litter 12.8 lb.; pasture 7 weeks; manual labour 493 hours; horse labour 62 hours. Other expenses amount to 27.7 % of the cost of feeds plus the cost of labour. In these accounts the meat and manure values etc. are not included nor the expenses of management. The net return per month is calculated, by taking the mean annual price at 100. (Ed.)

17. The cause and control of sandiness in ice cream.
18. The cause and control of deterioration in milk powder.
19. Seasonal variation in milk for evaporating.
20. The influence of salts on the growth of bacteria.
21. Chemical and physical changes in milk coagulation.

*Market milk section.*

1. Dairy sanitation :

Sanitary surveys are made of milk supplies in various cities at the request of local officials.

2. Milk plant management :

Studies are made of methods and costs of the various operations entailed in the handling and delivery of milk in cities.

Special studies are made of some of the various specific problems the milk-plant manager meets.

3. Methods of cleaning milking machines (1) :

Studies as to the best methods of cleaning milking machines.

4. Milk transportation :

Studies as to the best methods of transporting milk to the city with the least possible amount of loss from spoilage.

5. Special studies :

Special studies of the various properties of milk products, such as whipping quality of cream, etc.

6. Studies in the Unit Requirements for Producing Milk (2) :

Studies conducted for two years in each of seven different States.

*Dairy extension section.*

a) *Projects in cow testing association investigations :*

1. Influence of production on income over cost of feed.
2. Relation of production to returns on \$1.00 expended for feed.
3. Relation of production to feed cost per pound of butterfat.
4. Relation of production to feed cost per 100 pounds of milk.
5. Production as influenced by date of freshening.
6. Influence of size within the breed.
7. Effect of location.
8. Length of time large producers remain in the service, as compared with production period of low producers.
9. Decrease in production as lactation period progresses.
10. The cow as an economical producer of human food.

(1) Cf. M. J. THOMPSON, Observations on Milking Machine, *Agric. Exp. Station University of Minnesota, Report Dulu Substation*, 1918-19, pp. 25, 1920.

(2) Labour used in Bottling Milk, U. S. Department of Agriculture, Bureau of Animal Industries Milk Plant Letter 81, 1920; Milk Plant Letter 86, 1921 — With lever worked machines an average of 768 bottles an hour can be filled and sealed by one man.

Labour used in Washing Bottles, U. S. Dept. of Agriculture, Bureau of Animal Industries, Milk Plant Letter 83, 1921. (Ed.)

11. Increased production due to testing done by the association.
12. Relation between profit and the feeding of silage.
13. Relation between profit and the feeding of legumes.
14. The feeding of timothy.
15. Influence of pasture.
16. Summer dairying.
17. Daughters of purebred sires compared with the dams of the daughters.
18. Influence of age on production.
19. Production of milk and butterfat in relation to the butterfat test.
20. Variation in butterfat test due to season.
21. Variation in butterfat test due to point of lactation period.
22. Percentage of cows that fall below 3.25 per cent in the test.
23. Percentage of herds that test less than 3.25 per cent butterfat.
24. The tester and his work.
- b) *Investigations and study of co-operative bull associations.*
  1. Problems connected with methods of organisation and development.
  2. Study of the relative cost of bull service before and after organising.
  3. Studies of the results of the use of better bulls on herds belonging to members of bull associations
  4. Study and investigation of the problems and methods of handling vicious and unruly bulls as affecting the bull association organisations.
  5. Study of the abortion disease as affecting bull association organisations.
- c) *Study of cheese and cheese making.*
  1. Mountain cheese work in mountains of the south
  2. Studies and problems involved in the introduction of Swiss and other foreign cheeses into commercial factories.

*Dairy Division experiment farm.*

1. Effects of the various feeds and constituents of feed upon the animal body, upon growth, and upon the yield and composition of milk, and to find out the relative values of feeds for dairy production.
2. Effect of regular versus irregular milking.
3. Effect of milking two, three and four times per day.
4. Effect of keeping cows in stanchions versus box stalls.
5. Feed cost of raising heifers.
6. Raising calves on milk substitutes.
7. Feeding sweet potato meal to dairy cows.
8. Growing crops for the silo.

*Breeding experiments (dairy cattle).*

1. Comparing line breeding with the mating of unrelated animals ; comparing in-breeding with the mating of unrelated animals, as a means of fixing high production in dairy cattle ; also the effect of these methods of breeding on constitution, fertility and type.

2. An attempt to fix prepotency for high production by continued use of sires that have shown the ability to get high producing daughters, for generation after generation.

3. Statistical study of the effect of methods of breeding on production, from advanced register and register of merit data.

#### *Dairy manufacturing Section.*

1, 2, 3, 4, 5, 6. — Study of costs of butter manufacture, condensed milk, Camembert, Roquefort, and Swiss cheeses etc.

7, 8, 9, 10. — Study of the losses in milk and cheese manufactures.

11. Study of cream problems.

#### *Miscellaneous.*

1. Collection of dairy statistics relative to the milk industry, charting data and interpretation of statistics.

2, 3, 4. — Experiments in temperature control in dairy manufacture; control of humidity, and heat transmission.

5. Refrigeration.

F. D.

775 - **Unusual Odour of Wholesome Meat on the Refrigerator.** — MASCHERONI, E., in *Il Nuovo Frigoristi*, Year XXVII, No. 5, pp 76-77. Turin, Mar 15, 1922

The author has observed that wholesome beef and pork kept for several days in a refrigerator close to receptacles used to preserve oranges, resulted in a pronounced orange odour (especially the fatty portion), and occasionally in a bitter taste which rendered the meat uneatable.

The skin of the orange containing the essential oil (which possesses a very bitter terpene) cracks with the cold, setting free an essence which is easily absorbed by the organic liquid of the meat and especially of the fat, resulting in the odour and taste described above.

F. D.

AGRICULTURAL  
PRODUCTS  
PRESERVING,  
PACKING,  
TRANSPORT,  
TRADE

776 - **The Preservation of Forage by Means of Electric Current.** — *Rapport présenté par l'administration Centrale des Etablissements fédéraux d'essais et d'analyses agricoles de Liebefeld près Berne.* April 4, 1922, pp 1-6

The advantages of the electric current method of preserving fresh forage as compared with other processes such as ensilage and drying, are said to be the following: less loss of nutritive substances; reduction of labour; possibility of a better division of work, minimum expenditure of electric energy; the possibility of applying the process to the most varied agricultural undertakings and the preservation of all kinds of forage plants including those rich in protein substance; the forage can be carried in any weather and in any quantity; the work can easily be interrupted; good results are obtained by feeding this forage to dairy cows without affecting the quality of their milk; the electric current destroys all organic life in the mass of forage; the machines made by DERLIKON, the sole agent for this process in Switzerland, use only 1.3 to 2.0 kwh. for one hundred

kilogrammes of green forage, whereas the inventor calculated that from 2.5 to 2.8 kwh. would be required.

Electric ensilage, as far as is known at present, appears to be carried out in the following manner: the forage as soon as it is mown is cut up and put in the desired quantity into a silo of reinforced concrete. The forage mass rests between two electrodes and offers resistance to the electric current which heats it up to 50° C; the passage of the current is said to kill the plant cells and the bacteria in the forage.

During the autumn of 1921, Messrs DERLIKON carried out experiments at Liebefeld using a silo divided into three cases. The total cubage of 40.93 cub. m. was divided as follows:

Case A . . . . .	14.08 cub. m.
" B . . . . .	12.93 cub. m.
" C . . . . .	13.98 cub. m.

A three-phase electric current of 500 volts and 50 periods was employed. The questions to be considered were 4 in number.

1) The possibility of the general use of the electric silage process in comparison with the ordinary method, especially as regards labour and division of work.

2) The net cost of the preserved forage and the losses entailed during the operations.

3) The appearance and quality of the preserved forage.

4) The use of this forage by milch cows.

Equal quantities of grass of the same origin and identical botanical composition were preserved by the two silage processes. The two kinds of silage were fed to the same cattle, and in order to render the experiments more complete, the Liebefeld Federal Institute of Dairy Industry analysed the cheeses in order to ascertain whether the milk given by cows fed on electrically preserved forage was suitable for cheese-making.

The results obtained proved that electric ensilage has some advantages over the ordinary process, for it not only decreases the relative and absolute cost of labour, but requires no special knowledge on the part of the Staff. The chief advantage, however, is the better distribution of labour.

The chief obstacle to the general adoption of the new system is the present high cost of the plant and of the electric force required which is 5.7 kwh. per 100 kg., a figure exceeding the maximum estimated by the inventor.

Electrically preserved forage was taken from the silo between December 27, 1921 and January 15, 1922 and was found equal in quality to the ordinary product. It has, however, been noticed that the keeping qualities of electrically preserved silage, when once the pressure has been removed are inferior to those of silage made in the usual manner. The differences in the colour, taste and smell of the successive layers of electrically prepared silage are much more marked than in the case of ordinary silage which explains the preference or aversion shown by the animals to

forage taken from different strata. The appearance of electrically preserved forage is unattractive.

The annexed Table shows the content in nutritive substances of electrically preserved forage and ordinary silage respectively.

The results of the chemical analysis were taken as a basis for the calculation of the daily ration of the milch cows. A group of 4 animals were used, all of which were in the decreasing phase of the lactation period. The experiment lasted from the evening of December 5, 1921 to the morning of January 27, 1922. The live-weight of the cows remained practically stationary throughout the experiment, as also the milk secretion.

Institute where analysis was made	Layers	Crude protein	Crude fats	n-free extracts	Crude fibre	Ash	Water	Pure protein	Starch	Remarks
1	2	3	4	5	6	7	8	9	10	11
Berne Institute of agricultural chemistry	Es 1	3.2	0.4	4.1	4.1	2.8	85.4	3.05	0.15	Mean of 2 analyses
	Es 2	3.4	0.45	5.3	4.25	2.9	83.7	2.88	0.52	
	Es 3	3.5	0.6	4.9	5.8	2.6	82.6	3.02	0.48	Mean of 3 analyses
	Es 4	3.3	0.6	3.2	4.4	3.2	84.5	2.66	0.64	
	Es 5	2.5	0.7	6.8	3.8	2.6	83.6	1.8	0.70	
Agricultural chemistry Laboratory of the Poly- technic at Zurich	Sg 1	10.8	2.1	17.6	21.0	8.7	39.7	9.3	1.5	
	Sg 2	9.4	1.9	16.0	18.1	6.7	47.8	7.6	1.8	
	Sg 3	6.6	1.9	13.6	21.4	5.8	50.6	5.2	1.4	
Berne Institute of agricultural chemistry	Sg 4	5.6	0.8	5.3	5.5	4.9	77.9	3.5	1.85	
	Sg 5	5.7	1.2	16.4	7.5	5.6	63.6	4.7	1.0	

Note. Es represents the layers of electrically prepared forage and Sg those of forage made in the ordinary way

It was not possible to make experiments with any other kind of animal, or to discover the effect of the new forage upon the production of any other substance than milk.

The animals did not show much appetite for certain layers of electrically preserved forage although they always ate readily silage prepared by the ordinary method.

No ill effects or disturbances of the general health of the cows were however, noticeable during the experiment.

It may further be stated that the general and approximate nutritive value of 1 kg of hay was equal in round figures to that of 2 kg. of ordinary silage and of 4 kg. of electrically prepared silage.

To sum up, the conclusions to be drawn from the first experiments are as follows. although the hopes of the advocates of the new process were realised to a certain extent, the high cost of the electric method is

not in proportion to the advantages to be derived from it. Further, the forage does not keep well, and its general appearance, the losses during preservation, and the amount of electrical energy consumed do not tally with the statements made by its advocates. This remark also applies to the bacteriological properties of the forage.

This report makes it clear that exhaustive researches and very careful experiments are necessary before it will be possible to arrive at any definite conclusion regarding the practical value of the new process of preserving forage by electricity.

E. P.

## PLANT DISEASES

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

#### GENERAL

777 - **Fungi in Catalonia, Spain.** - FERNANDEZ, RÍOFRÍO, B., in *Boletín de la Real Sociedad Española de Historia Natural*, Vol XXII, No. 1, pp. 200-204. Madrid, Apr. 26, 1922.

In addition to the various species of micromycetes, mostly parasites of cultivated plants which have been already recorded for the Catalan flora, a further list has been made including other species found between 1912 and 1921 in different districts of Catalonia.

These species are not only new for this region, but they are to a certain degree, new also to Spain, and to the Iberian Peninsular.

*Uromyces Pisi* (Pers.) De Bary, although previously observed in Catalonia, has been observed for the first time as host for the leaves of *Pisum sativum*.

*Ustilago Panici-miliacei* (Pers.) Wint, on the panicles of *Panicum miliaceum*, is a fungus new to Spain.

Although *Exoascus deformans* (Berk.) Fuck. is probably very widely spread throughout Spain, it has, according to the author, never been notified in Catalonia. At the present time it has been observed on the leaves of *Amygdalus communis*.

In Pedralbes (Catalonia), *Uncinula necator* (Schw.) Burr has been observed on the leaves and fruits of *Vitis vinifera*. This is the second time it has been noted in Spain; this ascophore was found for the first time in Seville (Andalusia).

*Podosphaera tridactyla* (Wallr.) De Bary, found recently on the leaves of *Prunus Armeniaca* has not previously been recorded in Spain. *Septoria Lycopersici* Speg. var. *europaea* Br. and Cerv. on leaves of *Lycopersicon esculentum* and *Sept. Petroselinii* Desm. var. *Aprii* Br. and Cav., host of leaves of *Apium graveolens*, are also newly recorded species for Spain.

G. T.

778 - **The Mechanism of the Parasitic Action of *Penicillium glaucum* and of *Mucor stolonifer*.** - NOBÉCOURT, P., in *Comptes Rendus hebdomadaires des séances de l'Académie des Sciences*, First Half-year 1922, Vol CLXXIV, No. 26, pp. 1720-1722. Paris 1922.

*Penicillium glaucum* Lk. and *Mucor stolonifer* Ehrb. are two very common saprophytes living on a great variety of substances; these fungi are also sometimes found parasitic on a certain number of ripe or green fruits which they cause to rot more or less rapidly.



The author decided to ascertain the means by which the parasites produced the changes he had observed in the infected fruit.

He therefore inoculated fruits with spores from pure cultures of *Penicillium* and of *Mucor*. The rot spread with rapidity around the point of inoculation varying according to the kind of fruit inoculated. Tomatoes even when green are very quickly attacked by *M. stolonifer* and more slowly by *P. glaucum*; pears are very susceptible to *M. stolonifer*, while apples are most easily infested by *P. glaucum*.

When the fruits were completely rotten, the author took great care to prove that their condition was due to the fungus with which they had been inoculated.

The fruits after inoculation become more or less soft, and their disorganised tissues lost all cohesion owing to the dissolution of the middle lamellae connecting the cells. Microscopic examination shows the shrunken, granular, opaque protoplasm to be dead.

The juice of these soft fruits is easily expressed. After filtration, a rather dark yellow, slightly opalescent liquid with acid reaction is obtained. If different fragments of plant tissue such as peices of apple, pear, bean stalk, Jerusalem artichoke tuber, carrot, onion etc. are introduced into the liquid, the author found that after a certain time they became soft and their cells were plasmolysed and killed, that is to say, they had the same appearance as the tissues of the fruits parasitised by the fungi in question. The time necessary for the complete disorganisation of the fragments, or preferably of slices of plant tissue varies according to the nature of the plant, their thickness and the temperature. At 20° C, slices of carrot about 160  $\mu$  thick become completely softened and their cells are killed in about 3 hours. The short duration of these experiments show that the effects observed are due to substances present in the juices used and not to any micro-organisms that have developed in them subsequently to their preparation. Further, the same effects are produced in the same space of time if substances such as chloroform or toluene, which prevent the growth of micro-organisms, are added to the juices. The extracted juice of sound apples, pears, or tomatoes does not disorganise plant tissues.

The author thinks he has thus proved clearly that the deleterious effect produced on fruits by *P. glaucum* and *M. stolonifer* is due to substances secreted by these fungi which permeate the pulp of the fruit infected and are found again in the expressed juice. These substances, which may be called fungous toxins, are of an enzymoid nature and only act in an acid medium. The toxins secreted by *P. glaucum* and *M. stolonifer* act also upon the tissues of plants which the fungi themselves are unable to parasite such as carrots, Jerusalem artichokes, beans, etc.

The conclusion therefore seems justified that the immunity against these two fungi which is possessed by some plants is not due to the resistance of their tissues to the secretions of the parasites, but to other causes which the author intends to try and ascertain.

G. T.

MEANS  
OF  
CONTROL

779 - Control of Diseases and Pests in California. — See No. 679 of this Review

780 - The Control of Pear Scab in the Cape Province, South Africa. — PUTTERILL, V. A., in *Union of South Africa, Journal of the Department of Agriculture*, Vol. IV, No. 5, pp 430-431, figs 2. Pretoria, May 1922

Report of spraying experiments on the control of pear scab (*Fusicladium pirinum*) carried out in 1922 at Stellenbosch and in Somerset West (Cape Province). These experiments among other things have proved the importance and the necessity of spraying the trees four or five times at least during the season, either with Bordeaux mixture or with lime sulphur.

The following sprayings should on no account be omitted : — 1) when the buds are breaking and leaves just showing ; 2) when the flower buds have opened, but while the individual blossoms are still closed, that is, about 10 days later than the first spray , 3) when the last petals are falling, that is, about 10 days later than the second spray , 4) ten days to 2 weeks after third spray , 5) five weeks later

In orchards where the disease is particularly virulent, an extra spray might be given between sprays 1 and 2 and between sprays 4 and 5

Late susceptible varieties, if the summer season is wet, might with advantage be sprayed again 3 or 4 weeks after spray 5. Spray 3 coincides with the first spraying for codling moth (*Laspeyresia pomonella*), and the fungicide in this and other subsequent spraying can be applied with arsenate of lead for codling moth. Experiments have shown that no diminution either in *Fusicladium* or in codling moth is effected by using the combined mixture.

Spraying has resulted in a gain of about 60 % of clean fruit, and a net profit of at least 4s per average tree. In addition to this, there was a marked increase in the vigour of the tree.

The ascophore stage of the fungus (*Penturia pirina*) was discovered in South Africa in September 1921, for the first time. The fungus passes over from season to season in the fallen leaves, so that to obtain satisfactory control it is essential to have a knowledge of the stage when the fungus in such leaves is in a condition to infect the tree. The ascophore stage was found also in 1921 for the first time in New Zealand. G. T.

DISEASES  
OF VARIOUS  
CROPS

781 Wart Disease of Potatoes (*Synchytrium endobioticum*), observed in South Africa. — DOIDGE, E M, in *Union of South Africa, Journal of the Department of Agriculture*, Vol IV, No. 5, pp 117-151, figs 3. Pretoria, May 1922

In spite of the precautions taken since 1921 to prevent the introduction of wart disease of potatoes (*Synchytrium endobioticum*) into South Africa, the disease has been detected recently in one locality, in the Impendhle Division (Natal).

Immediate steps are being taken to discover the extent of the infection and to prevent it from spreading to other parts of the Union.

A detailed description is given of the disease, and the control methods so far adopted. G. T.

- 782 - *Urocystis Bolivari* n. sp. a Ustilaginea Parasitic on Perennial Ray-Grass in Spain. — BUBÁK, F., in *Boletín de la Real Sociedad Española de Historia Natural*, Vol. XXII, No. 4, pp. 205-207, figs. 2. Madrid, April 26, 1922.

This article gives a description of a new species of Ustilaginea, *Urocystis Bolivari* Bubák and Fragoso, found towards the end of May 1921 near Algodor (Prov. of Toledo), on perennial ray-grass (*Lolium perenne*).

This fungus attacks all the organs of the plant, so that it never heads, or else produces defective florets.

This new species of Ustilaginea recalls by its external characters *Ur. occulta*, while in the form assumed by its clusters of chlamydospores it much resembles *Ur. Agropyri*.

G. T.

- 783 - *Fomes* sp. Root Disease of Rubber in Malaya. — See No. 716 of this Review

- 784 - *Sclerotium cepivorum*, a Garlic Disease called "boixat" in Catalonia, Spain (1). — CABALLERO, A., in *Boletín de la Real Sociedad Española de Historia Natural*, Vol. XXII, No. 4, pp. 210-212. Madrid, April 26, 1922.

For the last twenty years, the large garlic fields in the district of Bañolas (Prov. of Gerona), have been seriously attacked every season by a disease known to the local agriculturists under the name of "boixat" ("boixadura"). In 1914, the losses occasioned amounted to three hundred thousand *pesetas*, about 30 % of the total value of the crop.

Although first attributed to the presence of a bacterium, and afterwards to the attack of a Nematode, sometimes in association with other animal or plant parasites, the chief cause of the malady as has been repeatedly proved by the author, is a fungus, *Sclerotium cepivorum* Berk.

In order to control this pest, it is necessary to burn all infected plants; to suspend the cultivation of garlic in the places most contaminated by the disease, and to immerse all suspected bulbs before planting in a  $\frac{1}{3}$  % solution of formalin.

G. T.

- 785 - American Gooseberry Mildew (*Sphaerotheca mors-uvae*) reported from Piedmont, Italy. — GABOTTO L., in *Il Coltratore*, year LXVIII, No. 17, pp. 522-525, 1 fig. Casale Monferrato, June 20, 1922.

American Gooseberry Mildew (*Sphaerotheca mors-uvae* [Schw.] Berk. and Curt.), which was recorded for the first time in Italy in 1914, in the Province of Pavia (2) was also found in 1920-1921, in the Province of Novara, and is now attacking gooseberries in the districts of Asti and Casale-Monferrato (Prov. of Alexandria).

The author gives advice as to the control measures to be adopted against this Frysiphaea.

G. T.

(1) See also *R.* Oct. 1920, No. 1048. (Ed.)

(2) See *R.* Dec. 1914, No. 1188. (Ed.)

786 - *Fusicladium* sp. and *Entomosporium* sp. on Loquat in the Cape Province, South Africa. — PUTTERILL, V. A., in *Union of South Africa, Journal of the Department of Agriculture*, Vol. IV, No. 4, pp. 332-337, figs. 7. Pretoria, April 1922.

Towards the end of 1920, it was noticed that leaves of the loquat (*Eriobotrya japonica*) from Kenilworth (Capetown), were attacked by a disease resembling that caused by the apple and pear scab (*Fusicladium dendriticum* and *Fus. pirinum*). In October 1921 half-ripened fruit showed similar signs of decay. On the leaves, the diseases is seen on the under side as olive-green velvety spots; usually the leaves so affected become misshapen. On the fruits similar spots are produced. The outer layers of the fruit develop radiating fissures. The disease is thus very similar in appearance to apple and pear scab, especially the former (1). In some cases the fruits were totally destroyed and the leaves and branches badly attacked.

This disease has not been previously recorded in South Africa but probably it has been in existence there for about nine or ten years. It is not known if this fungus forms an ascophore in old leaves as is the case with *Fus. pirinum* and *Fus. dendriticum*, although such a means of hibernating is hardly necessary as the loquat is an evergreen.

Although no definite measures have yet been taken to combat these attacks, the following suggestions, if carefully followed, should give satisfactory results: 1) Old leaves and fruits should not be permitted to remain under the trees, but should be collected at frequent intervals and burnt; 2) badly diseased twigs should be cut and burnt; 3) the disease is not likely to spread much during the dry summer months, so that the trees should not be sprayed more than every two months, from November to April. If the trees show only slight symptoms of attack, two or even one spraying during this period should be sufficient. More frequent spraying from thence onwards up to the time the fruit is of a fairly large size is essential. The number of sprayings will depend largely on the intensity of the disease. As the rainfall is fairly high during the winter months, the amount of rain is another factor which will have a bearing on the number of sprays necessary; Bordeaux mixture 4:4:50 or lime sulphur 1:45 should prove satisfactory. Good results have been obtained with lime sulphur in Rondebosch (Capetown).

Another disease has been observed in only one locality, viz. at Wynberg (Cape Province) on loquats badly attacked by *Fusicladium*, though it is known to exist in other parts of the Union. This disease appears on the fruit as small, circular, shiny black spots, somewhat convex in shape. When these spots are very numerous and aggregated into patches, the disease looks, at first sight, very much like *Fusicladium*, though when they are isolated the two diseases are readily distinguishable. On the leaves

(1) Probably the present disease notified in the Cape Province is identical with loquat scab (*Fus. pirinum* var. *Eriobotryae*), already reported several years ago in Italy by SAVASTANO See R May 1918, No 599 (Ed.)

the disease is much less noticeable than *Fusicladium*; small, circular, reddish brown spots surrounded by yellow are formed.

This disease is caused by *Entomosporium* sp. In South Africa, a very common disease of the quince and the pear known as "leaf blight" does much damage, especially in Natal and in the Orange Free State; it is caused by a similar if not identical *Entomosporium*. The ascophore (*Fabræa maculata*) is found on the old fallen leaves. The winter ascophore stage is not known in the case of loquat blight.

The measures taken against loquat *Fusicladium* should be equally effective against *Entomosporium* on the same plant G. T.

787 - *Cenangium Abietis*, Ascomycete injurious to Spruce Pine in Switzerland. BADOUX, H., in *Journal forestier suisse*, Year LXXIII, No 6, pp 101 104 Berne, June 1922

*Cenangium Abietis* Duby, which as a rule is a simple saprophyte found fairly often on the branches of various Conifers, has been noticed sometimes to behave as a parasite, fatal to large trees and capable of spreading rapidly. Attention is drawn to the serious damage caused by this fungus in Germany (especially from 1891 to 1895) to pines of all ages, from about 5 years onwards.

In 1921 (Pomerania), saplings of 1 year were noticed to be attacked. *C. Abietis* was observed between 1914 and 1918 as a dangerous parasite on the white Pine in several parts of Switzerland (Zurichberg, Horgen, Rothenbourg) and in 1921 was found in the Hinterholz forest, in a closely packed stand of Pines of 60 years old, on alluvium of medium depth. Within a radius of 100 ares the trees died off from the top downwards and decayed rapidly. The attacked trees were cut down. The contaminated wood appeared to be very brittle, a transverse section showed a blackish tint which would render the timber useless for commercial purposes. Only 90 cub m of the 587 cub m felled in 1921 have been utilised for building purposes etc.

In order to stop the spread of this attack the stand in question has been well cleared in certain places G. T.

## WEEDS AND PARASITIC FLOWERING PLANTS

788 - Control of *Orobanche crenata* on Beans. MATTEI G. I., in *Allgemeine Year III*, pp 86 87 Palermo, March 1922

Small scale practical experiments covering a period of two years. In a series of pot experiments the author used identical quantities of the same type of soil and made comparative trials with guano coming from the Dalak islands distributed in minute and larger quantities in the various pots together with beans damaged by *Orobanche crenata* (= *O. speciosa*). Results show that guano if not applied too vigorously, hinders the development of *Orobanche*, without detriment to the bean.

Although up to the present, it has not been possible to determine the amount of guano required to obtain the best results, the author considers that further experiments should be made on a large scale, to ascertain the

practical value of this discovery and this applies especially to the Sicilian farmer who as is well-known, suffers great loss as a result of Orobanche attacks on the bean. G. T.

789 - **Mistletoe on the Spruce Pine in Switzerland.** — DELACOSTE, F., in *Journal forestier suisse*, year LXXIII, No. 5, pp. 90-91, figs. 1. May 1922.

In a forest near St. Maurice (Canton Valais), in March 1922, an unusual variety of the mistletoe (*Viscum album*) was observed slightly below the top of a pine, some 60 years old.

This Loranthacea is found in large and numerous clumps on the silver pine and white pine in the same forest, and on the fruit trees on the neighbouring plain.

The form of *album* observed on the pine may be distinguished by the yellow, narrow-shaped leaves when compared with other varieties, found on white pines and fruit trees.

In 1918 the mistletoe had already been noticed in Valais on pines in the forest of Saxon. G. T.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

### GENERAL

790 - **Some Injurious Neotropical Weevils (*Curculionidae*).** — MARSHALL G. A. K., in *Bulletin of Entomological Research*, Vol. XIII, Pt. I, pp. 59-71, figs. 4, pl. 2. London, May 1922.

Amongst the species of Curculionidae here described for the first time as new to science, or only casually mentioned are the following:

1) *Diaprepes capsicalis* n. sp., observed in Rio Piedras (Porto Rico); the adult of this species has been observed feeding on leaves of pepper (*Cap-sicum* sp.).

2) *Exophthalmodes roseipes* Chev. (hitherto described as a *Pachnaeus*); the adults attack the leaves of cotton at Isabella (Porto Rico), but the species is more abundant on citrus trees.

3) *Lachnopus coffeae* n. sp., observed at Rio Pedras; the adult feeds on young leaves of coffee.

4) *Lachn. coffeae montanus* n. subsp., found at Yauco (Porto Rico); feeds on young leaves of coffee.

5) *Cholus wattsi* n. sp., collected in Grenada where the larvae and adults cause serious damage to the pine apple. The chief injuries result from attack of the fruit stalk. The control of this pest lies in clean weeding and removal of bushes and cultivation away from the influence of shade. Pineapples should be planted in straight and regular rows with sufficient distance between the rows to permit clean weeding. If properly planted and carefully tended plantations are attacked by the weevil, it should be possible to check such an attack without much loss, by collecting the weevils found hiding in the axils of the leaves and by cutting out and destroying any infested fruit, to remove any hidden larvae.

6) *Conotrachelus psidii*, n. sp. found in Bahia (Brazil); attacks the fruit of *Psidium Guayava*.

7) *Coelosternus granicollis*. Pierce ; attacks stems of cassava (*Manihot utilisima*) in Bahia.

8) *Piazurus papayanus*, n. sp., also found in Bahia, the larvae bores into the leaf stems of the papaw (*Carica papaya*).

9) *Lechriops psidii*, n. sp., collected in Mayaguez (Porto Rico) ; the larvae feed on the fruits of *Ps. Guayava*, which shrivel up as a result of attack.

G. T.

791 - Observations on *Tortrix viridana* in Spain. — AULLÓ, M., in *Revista de Montes*, year XLVI, No 1067, pp 10-11, figs 1. Madrid Jan. 1, 1922.

Observations were made during the first part of 1921, in the oak woods at Villaneuva de Cordoba, where the *Tortrix viridana* has been seen in abundance, in conjunction with the Macrolepidoptera, *Malacosoma neustria* and *Lymantria dispar*. Mating of the adults of this Microlepidopteron starts in the warm early hours of the morning, and continues for about 3 hours ; eggs are not laid at once, but two or three days later, after the female has had time to choose the most advantageous spot for the purpose.

According to the observations made both of captive specimens and during several hours watching in the open it has been noticed that frequently after remaining for a long time on the branch, the female goes away without laying. When, and however, and laying takes place, the female after going the length of the branch, places herself in an attitude parallel to the axis, bends the abdomen at the lower end, sways backwards and forwards moves herself along the branch leaving a mass of small scale sand scraped bark where finally lays the eggs, these are thus lightly covered, but under such conditions that they can only be distinguished with difficulty.

The number of eggs found in each spot is variable ; on the branches examined, from one to four have been counted ; the eggs when recently laid were of a light yellow colour.

The fact which has often been observed that it is at the beginning of the growth period that the caterpillars of *T. viridana* make their appearance, may be attributed to the method adopted by the female in laying, namely placing the eggs on the host plant where the new shoots should develop the following year. In this way, the caterpillar becomes enveloped at its birth by the plant nutritive organisms. It should not therefore be supposed that the caterpillar migrates from the trunk to a fixed point at the tops of the trees, which would be the case only if the trunk bark was, as is sometimes believed, the normal place for the egg-laying.

G. T.

792 - Meade Cotton resistant to Boll Weevil (*Anthonomus grandis*) in the United States. -- See No. 713 of this Review.

793 - *Upupa epops indica*, And its Utility in India --- FLETCHER, T. B. and INGLIS, C. M., in *The Agricultural Journal of India*, Vol. XVII, Pt. II, pp. 113-118, figs. 1, pl. 1. Calcutta, 1922.

Except in Sind and Western Punjab, the Indian hoopoe (*Upupa epops indica*) is one of the most familiar of the birds living in the Plains of India.

RESISTANT  
PLANTS

MEANS  
OF  
CONTROL

It occurs abundantly in suitable localities in India, Burma and Ceylon. It is found chiefly in open country and is essentially a ground bird, only occasionally perching in the trees. Its food consists of insects, sometimes of cutworms found chiefly below the surface of the ground and rarely in the trees.

The young nestlings are fed almost entirely on caterpillars (probably all of *Noctuidae*), and on larvae of *Melanthinae* and *Gryllidae*. The quantity of food consumed during the day by half-developed nestlings is considerable.

From an examination of the stomach contents of 24 birds at Pusa, C. W. MASON found that these had swallowed 278 insects of which the majority belonged to injurious species.

In recognition of its agricultural utility, this bird is protected throughout the year in Bombay, Delhi, United Provinces, Bihar, Bengal, Assam, Burma and in Madras (Shevaroy Hills).

G. T.

**INSECTS, ETC.  
INJURIOUS  
TO VARIOUS  
CROPS**

794 - **Unidentified Dipter on Lucerne in Italy.** DRAGHETTI, A., in *L'Italia agricola* Year LIX, No. 3, pp. 82-83. Piacenza, March 15, 1922.

Misshappen inflorescences exactly similar to those observed by DENATIFFE and COLLE (1) on lucerne in Carignan (France), have been reported near Forlì (Romagna) in 1920, on selected parent plants, and scattered here and there over a series of plots, also serious damage is reported in a lucerne area in 1921.

Examination of flowers attacked showed that the damage is caused by a gall insect which changes the flowers into actual galls. The author is led to believe that the real agent responsible for attack is the same Dipterous, or a species very similar to that which injures the flowers of the lotus (*Cecidomyia loti*).

With lucerne the attack coincides with the appearance of the first flowers of the May and June-July crop, but hypertrophied flowers are also to be found in the following crops. The damage is not limited to undeveloped flowers, which, however, may be a serious matter, but may also affect a small proportion of normal flowers, delaying flowering time and attacking the upper portion of the inflorescence, and resulting in a decreased quantity and an inferior quality of seed.

G. T.

795 - **"Murda", a Disease of Pepper Plants, caused by an Unidentified Mite.** — KULKARNI, G. S., in *The Agricultural Journal of India*, Vol. XVII, Pt. I, pp. 51-54, pl. 2. Calcutta, 1922.

The most outstanding pest associated with the pepper plants (*Capsum*) in the Pres. of Bombay is a form well known to planters under different names, "murda", "goja", "macoda", mirya (in the Deccan), chandiroga or mnt lagariroga (in the Karnatik), "kokadva" (in Gujarat).

(1) See R. Jan 1922, No. 129. (Ed.)



The symptoms appear first on the terminal and axillary shoots. The leaves attacked curl up at the edge and wither; they often become twisted, curled and crumpled and gradually dry up and fall off. New shoots are formed and are attacked in the same way, and the development of the plant is hindered. The symptoms are noticeable at all stages of growth. If attacked when very young, no flowers or fruits are produced; if later and during the flowering period, the larger proportion of flowers attacked fade and fall off, and the small number left give fruits which rot quickly. The fruits attacked are much smaller than the normal and are curved. The disease spreads gradually to the lowest branches and as the internodes are shortened, the leaves appear to be aggregated in patches and the structure resembles scale formation. The plant is therefore seriously misshapen, and is hardly recognisable. A serious attack was reported in 1920, near Poona, in the Baramate valley, where there was a crop failure in nearly all the fields. Damage was recorded also in Byapour, Gokak, Kolhapour, Khed, Amalsad and Anand.

The cause of this disease is attributed to the same mite which attacks the potato, and is known as "tambera" (1).

In June 1920, the mite was found on the diseased pepper plants in all its stages and corresponding to that already observed on the potato. The exact cause of the two diseases was soon discovered after practical experiments were made by placing diseased portions of pepper on potato plants, and by inoculating *Capsicum* plants with mites living on the potato plant.

Preliminary control measures undertaken in seven different centres in the Presidency, have shown that a lime sulphur spray is sufficient to combat this pest, if it is used directly the first symptoms of attack are shewn.

The mite limit its attacks to the potato and the pepper, but also infests *Cyamopsis psoraloides*, *Zinnia*, *Dahlia*, *Tagetes*, *Mirabilis Jalapa*, *Physalis minima*, *Phys. peruviana*, *Amaranthus polygamus*. The effect on *Zinnia* is especially serious and frequent. Cross inoculation experiments made with the mite found on this Composita, with other *Zinnia* spp. have in every case given positive results.

As regards its identity the mite corresponds exactly with the description and photographs of the yellow Acarien belonging to the *Tarsonemus* found by WATT and MANN to be harmful to the tea plant. It is considered probable therefore that the mite found on the pepper plant is a *Tarsonemidae* species. G. T.

**796 - The Gall Form of Vine Phylloxera, observed for the first Time in New South Wales.** — PROGGATT, W. W., in *The Agricultural Gazette of New South Wales*, Vol XXXIII, Pt. 5, p 360, pl 1 Sydney, May 1922

In the Hawlong nurseries, the leaves of *Riparia* × *Rupestris*, planted several years ago were observed recently to be covered with "phylloxera" galls.

(1) See R. June 1921, No. 696. (Ed.)

According to the author it is the first time that a gall form of *Phylloxera vastatrix* has been noticed in New South Wales. G. T.

797 - "The Tukra" Disease of Mulberry caused by *Phenacoccus hirsutus* in Bengal. — MISRA, C. S. (First Assistant to Imperial Entomologist), in *Agricultural Research Institute, Pusa, Bulletin* No. 109, pp. 610-618, pl. 1, Calcutta, 1921.

The disease of the mulberry, locally known as "Tukra" in Bengal is caused by the coccid *Phenacoccus hirsutus* Green, and not by *Dactylopius bromeliae* Bouché as hitherto believed.

It was noticed for the first time in Pusa in 1908, and was seen later in the Murshidabad, Marda and Ban-Kura silk-producing districts. In the first mentioned area the disease was already very widely distributed in 1900 and the damage serious. Probably it is to be found in other mulberry-silk-producing districts in Bengal.

The shoots of the affected plants first turn coppery green, then pale yellow and ultimately become so hard and compact that it is not possible to open them without breaking off the shrivelled leaves. With the appearance of the malformed shoots, the lower lateral leaves become seared and fall off prematurely. In cases of severe attack, the bare stems are left. The apical leaves, if they do not turn pale yellow, become so crisp and devoid of nutrient constituents that they become unfit for the silkworms. The disease is very widespread during some years and considerable damage is done to the leaf crop, and consequently there is a heavy loss to the cultivator.

The disease seems to have obtained a footing in the silk-producing districts of Bengal for the following reason: the remedies hitherto adopted for eradicating the pest consisted in the collection of affected shoots and throwing them outside the infested fields into a neighbouring ditch or pool; the nymphs as well as the mature females crawled from these and invariably infested the succeeding crop. In addition this, the nymphs and the gravid females were blown away by the wind with fallen leaves, and nymphs and females of *Phen. hirsutus* have also been transported to new places by means of the nymphs and females of *Pseudococcus virgatus* Ckll as well as other insects.

At Pusa, *Phen. hirsutus* has been found on *Morus* spp., on cotton, and on potted *Ficus religiosa* plants kept near the potted mulberry plants. Close to these were also *Eugenia jambolana*, *Ficus glomerata*, sugar cane, rice and *Citrus decumana* plants, but none of these were attacked.

The author has been able within a short time to reproduce the disease on healthy potted mulberry plants which showed all the usual symptoms noted in the field. In addition to this he succeeded in rearing one complete cycle of *Phen. hirsutus* on *Ficus religiosa* plants in pots.

On mulberry plants in pots, *Pseudococcus virgatus* has been found to occur along with *Phen. hirsutus*, but experiments have shown that nymphs and females of the former may easily be distinguished from the eggs, nymphs and adults of the latter. *Phen. hirsutus* occurs also on cotton

along with *Ps. corymbatus* and *Ps. virgatus*, but in this case also they may be easily distinguished.

The nymphs and females of *Phen. hirsutus* are parasitised by 3 unknown species of Chalcidae, one of which is very widespread. A Cecidomyad fly, *Diadiplosis indica* E. P. Felt is parasitic on the eggs, nymphs and gravid females. The larvae of *Eublemma* sp (allied to *quadri-lineata*) also feeds on the nymphs and females

Colonies of *Phen hirsutus* living on the mulberry and on *Ficus religiosa* are also attacked and devoured by the larvae of *Spalangia epus*, a very effective agent for destroying this pest.

G T.

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INTERNATIONAL INSTITUTE OF AGRICULTURE  
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INTERNATIONAL REVIEW OF THE SCIENCE  
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FIRST PART  
ORIGINAL ARTICLES

**Problems of Cotton Growing (1)**

by Dr. FABRIZIO CORTESI

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On the eve of the international cotton Conference which will be held at Rio de Janeiro in October, it may be useful to give certain information corroborated by biological and statistical data, regarding some of the more important fundamental questions relating to cotton growing.

This article is divided into three chapters; in the 1st the present possibilities of developing the growth are examined; the 2nd is devoted to the study of the seed, and in the 3rd a rapid survey is made of the diseases which injure, and often destroy this important crop.

I. -- PRESENT POSSIBILITIES OF DEVELOPING  
THE GROWTH OF COTTON.

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If the statistics of the cotton production of the world are examined, it is seen that, on the whole, it has decreased chiefly owing to a decline in the United States yield

The data published in the *Annuaire International de Statistique Agricole* from 1909 to 1921, give the following totals for the different parts of the world (Table I)

TABLE I. — *Total production of cotton in the world from 1909 to 1922.*

Regions	Area (ha).			Production of ginned cotton (qx)		
	1909-10 to 1913-19	1914-15 to 1918-19	1919-20 to 1921-22	1909-10 to 1913-14	1914-15 to 1918-19	1919-20 to 1921-22
Europe . . . . .	10 224	9 884	11 878	30 116	22 003	25 829
North and Central America . . . . .	13 928 268	14 087 255	13 686 822	28 706 594	27 267 137	24 334 734
Asia . . . . .	9 187 086	9 052 552	8 691 854	7 863 226	7 939 332	8 643 176
North Africa . . . . .	759 816	732 577	775 656	3 229 074	2 550 543	2 383 932
South America . . . . .	272 174	309 533	476 809	879 097	977 300	1 440 637
South Africa . . . . .	26 045	27 366	25 789	28 671	21 483	20 302
Oceania . . . . .	150	45	3 140	163	72	735
Grand Total . . . . .	24 183 763	24 219 212	23 671 948	40 730 911	38 786 870	36 849 345

Table I, which gives the averages of these recent years, shows also that the decrease in the area cultivated, which in round numbers is about one and a half million hectares, does not correspond with the decrease in production, which exceeds four million quintals; the latter being much greater in comparison with the decrease of the area cultivated, since according to Table II in the above-mentioned *Annuaire* the average of production per hectare varies between 1.6 q. and 1.7 q. Other causes have therefore influenced this decrease, which will be examined later in considering certain fundamental questions in the world's cotton problem.

If the figures relating to the statistics of the world's production in various countries are examined in detail, we see that there are at present three principal cotton centres in the world, all situated in the Northern hemisphere, namely — the United States of America, which produced in 1909-10/1913-14, 28 258 194 qx., in 1914-15/1918-19, 26 937 344 qx., in 1919-20/1921-22, 23 994 679 qx.; British India, with the following pro-

duction :— in 1909-10/1913-14, 7 770 220 qx., in 1914-15/1918-19, 7 785 099 qx., in 1919-20/1921-22, 8 391 671 qx. ; Egypt, with the following production :— in 1909-10/1913-14, 3 149 782 qx., in 1914-15/1918-19, 2 462 037 qx. in 1919-20/1921-22, 2 232 576 qx

Brazil, chiefly in the Southern hemisphere comes next with —

1919-10 — 1913-14	611 900 qx.
1914-15 — 1918 19	675 460 »
1919-20 — 1920-22	1 045 304 »

Regarding the yield per hectare, which is a very important coefficient, it is given, according to the above-mentioned *Annuaire*, for a number of countries in Table II (p 930)

These figures are very important, because they show that, except in Peru, where the average production per hectare is the highest, Egypt and Japan, where the averages always exceed 3 qx per hectare, in the other countries (including the United States which is the greatest cotton centre in the world), the averages are very low and in certain countries almost negligible. These figures indicate that the chief cotton region of the Northern hemisphere is Egypt where the averages always exceed 3 qx and often 4 qx. per hectare, while in the Southern hemisphere, the averages reach and exceed 3 qx. per hectare in South America. The Southern hemisphere has higher averages than the Northern hemisphere, indeed almost double.

Apart from the decrease in the total area cultivated, the decrease of the world's cotton production is due also generally to the almost continuous decrease in the production of cotton per hectare, which is shewn in Table II.

\* \* \*

The above paragraphs give the present position of the world's cotton production and the question of the future possibilities of development next arises.

In certain countries, such as Brazil, in certain central and eastern parts of Africa and in certain parts of Asia, the production of cotton is susceptible of great extension and probably this is the case for China, Manchuria and Korea.

J. A. TODD in a very interesting article published in a recent number of *The Agricultural Journal of India*, recognises that Brazil is a very important centre of cotton production capable of very great development. Further, it should not be forgotten that the *International Federation of Master Cotton Spinners* has recently sent representatives to Brazil to investigate and study on the spot the possibilities of cotton production ; and that this mission, which is composed of members of unquestionable authority, has recognised that Brazil possesses most favourable conditions of climate and soil for becoming a centre of cotton production. of the highest importance. It is certainly necessary that all measures calculated to encourage planters as effectively as possible should be taken and that all modern

TABLE II. — *Unitary production of cotton in the world from 1909 to 1922.*

Number	Country	Yield: quintals per hectare		
		1909-10 to 1913-14	1914-15 to 1917-19	1919-20 to 1921-22
1	Bulgaria . . . . .	2.3	1.1	1.8
2	Greece . . . . .	(1) 3.0	2.5 (1)	2.2
3	Malta . . . . .	2.3	2.1	2.2
	<b>Europe . . . . .</b>	<b>2.9</b>	<b>2.2</b>	<b>2.2</b>
4	Antigua . . . . .	1.8 ( )	1.1 (1)	1.3
5	Barbados . . . . .	1.4	1.3 (1)	1.0
6	United States . . . . .	2.0	1.9	1.7
7	Grenada . . . . .	—	(3) 1.0 (1)	1.3
8	Dutch West Indies . . . . .	(4) 2.4	2.5 (1)	2.5
9	Jamaica . . . . .	—	2.5	—
10	Mexico . . . . .	—	—	—
11	Montserrat . . . . .	1.7	1.7	1.8
12	St Kitts and Nevis . . . . .	1.6	1.5	1.5
13	St Vincent . . . . .	1.2	0.8	0.8
	<b>North America . . . . .</b>	<b>2.1</b>	<b>1.9</b>	<b>1.8</b>
14	Cyprus . . . . .	—	(1) 0.4	1.3
15	British India . . . . .	0.9	0.9	1.0
16	Indo China . . . . .	—	(4) 1.1	—
17	Japan . . . . .	3.6	4.1 (3)	3.9
18	Korea . . . . .	0.9	1.2 (3)	1.5
	<b>Asia . . . . .</b>	<b>0.9</b>	<b>0.9</b>	<b>1.0</b>
19	Algeria . . . . .	—	—	—
20	Egypt . . . . .	4.5	3.9	3.3
21	Uganda . . . . .	2.1	1.0	1.4
22	Anglo-Egyptian Sudan . . . . .	(4) 1.7 (1)	1.0 (3)	1.5
23	Togo (French zone) . . . . .	(3) 0.4	0.3	0.5
	<b>Africa . . . . .</b>	<b>4.2</b>	<b>3.5</b>	<b>3.1</b>
	<b>Northern Hemisphere . . . . .</b>	<b>1.7</b>	<b>1.6</b>	<b>1.5</b>
24	Argentina . . . . .	(4) 2.9	2.9 (3)	2.6
25	Brazil . . . . .	(4) 3.0 (4)	2.9	2.8
26	Peru . . . . .	—	4.3 (3)	5.3
	<b>South America . . . . .</b>	<b>3.2</b>	<b>3.2</b>	<b>3.0</b>
27	Belgian Congo . . . . .	—	(3) 0.3 (3)	0.3
28	Nyasaland . . . . .	(4) 0.9	0.9 (3)	0.6
24	Tanganyika . . . . .	(2) 1.9	—	(1) 1.5
30	Union of South Africa . . . . .	1.7	1.7 (3)	1.4
	<b>Africa . . . . .</b>	<b>1.1</b>	<b>0.8</b>	<b>0.8</b>
31	Australia . . . . .	1.0	1.4 (3)	1.5
	<b>Southern Hemisphere . . . . .</b>	<b>3.0</b>	<b>3.0</b>	<b>2.9</b>
	<b>General Averages . . . . .</b>	<b>1.7</b>	<b>1.6</b>	<b>1.6</b>

(1) One year only — (2) Average of 3 years — (3) Average of 2 years — (4) Average of 4 years



cultural methods directed towards industrialisation and high production should be introduced.

In the report presented by Dr. DE CAMPOS to the VIth General Assembly of the International Institute of Agriculture it is stated that in certain regions of Brazil, such as the State of São Paulo and in the North-East, there are very high unitary yields of cotton, which exceed the averages of any other country

Local varieties are very important and have a great future. The variety Riqueza has a very fine fibre, strong, flexible and glossy. "Mocó" (which can be grown very successfully in Seridó) produces a fibre 45 mm long and, in that region, the plant becomes perennial, producing bolls for 10-15 years, while in Egypt a somewhat similar species is annual, requiring more labour, and giving a smaller yield of fibre. Another important variety is "Rim de Boi" the herbaceous short stapled cotton plant has the advantage that it can be grown in places which are unsuitable for other species and that it develops very rapidly thus, at Alagôros and Sergipe, only 3 months elapse between planting and picking, while at Maranhão one month and a half is said to suffice

In recent years the cotton production of Brazil has increased considerably, as the following statistics, taken from the previously mentioned *Annuaire*, show. On the other hand it has decreased very much in other countries

Years	Quintals
1915-16	611 900
1916-17	608 327
1917-18	747 154
1918-19	734 461
1919-20	832 971
1920-21	977 842
1921-22	1 326 000*

\* The figures 1921-22 are approximate

According to HIMBURY, quoted by Prof RICCI in his report, there are distinct possibilities for the development of cotton growing in British Colonies in Africa and especially in Nigeria, whence 16 000 bales (of 400 pounds each) were exported in 1920, and some day there may be a production of one million bales, in Uganda, a country where cotton was unknown 16 years ago, the production was 53 000 bales in 1920 and anticipations of the future point to 500 000; in the Sudan 22 000 bales were obtained, and there is a possibility of favourable development up to 1 500 000. Altogether Great Britain might possibly obtain from these three colonies, after a lapse of years 3 million bales of 400 pounds, which would represent  $\frac{1}{7}$  of the present total production of the whole world.

There are also certain possibilities for the development of cotton growing in Erythrea, in the districts situated on the Anglo-Egyptian frontier and along the coast; but it will be necessary to bring to a conclusion

the experiments in selection of some American varieties of the "American Upland" type, and especially of the variety "Triumph" and of some short stapled "Orleans" kinds which have given excellent results. Italian Somaliland, especially the region of middle Ouébi Schébé, where the Duke of the Abruzzi has started a large farm and extensive irrigation works are being carried out, contains plains where by means of irrigation cotton planting could be considerably developed.

Before the war the Russians were investigating, the possibility of intensifying and extending the growth of cotton in Transcaucasus and in Turkestan.

The following figures have been quoted for Russia in Asia :—

Years	Quintals
1909-10 . . . . .	906 967
1910-11 . . . . .	1 500 787
1911-12 . . . . .	1 604 945
1912-13 . . . . .	1 134 225
1913-14 . . . . .	1 449 747
1914-15 . . . . .	1 574 605
1915-16 . . . . .	2 145 209

Unfortunately the present conditions exclude the possibility of any reliable forecasts or estimates.

In the United States, which is the greatest centre of world cotton, production has decreased, both on account of some reduction in area under cotton and of the significant decrease in the unitary yield. In fact from a maximum production of 34 983 423 qx. obtained in 1914-15 production went down to a minimum of 18 082 538 qx. in 1921-22.

The case of Egypt is similar and the decrease has been equally marked. Egyptian production reached its maximum in 1913-14 with 3 443 193 qx. and its minimum in 1921-22 with 1 482 624 qx. One of the principal causes of this decreased production in Egypt is to be found in infections, especially the "pink bollworm", while other contributory factors are want of manure, continuous cropping, and too long continued growth on the same ground and the state of the soil in relation to irrigation and drainage.

A region which may perhaps have some future for cotton planting, when the political problems and those of irrigation and labour have been solved, is Mesopotamia, where there is a possibility of utilising more than 121 000 ha., along the banks of the Tigris and the Euphrates. Experiments, undertaken by Capt. R. THOMAS in 1918 and continued in the following years, gave promise of eventual, good results.

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From this rapid examination the following conclusions may be drawn.

1) The growth of cotton in the different countries of the world is susceptible of substantially increased development, especially through

encouragement in those new countries in which conditions are particularly favourable.

2) The causes of the present decrease in the world's production of cotton are due to the decrease in the area cultivated and especially to the decrease in the unitary yield.

3) The decrease in yield is due to complex causes, among which are — deterioration of the species grown in the absence of good selection methods, the still imperfect cultural methods followed in many regions and the insect pests which in certain countries destroy a large portion of the crops.

4) The unitary yield probably depends on a combination of geographical and ecological factors which require detailed study and exact determination in the interest of the world's future cotton production.

5) In cotton statistics, it is necessary to distinguish between the production of long stapled and short stapled species, the more so because, from the standpoint of manufacture and market prices, these two types of cotton may be considered in many respects as different products

## II — THE PROBLEM OF SEED

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Another problem of capital importance in the cotton question is that of seed. The success or comparative failure of cotton crops depends specially on the quality of the seed used.

The most serious fact which impairs both the quality and quantity of the product originates from the mixing of the seed which takes place during the operation of ginning the cotton. If the ginning machines are not perfectly cleaned, a small quantity of the seed of one variety remains, and gets mixed with the next variety. The impurity of the seed results in the mixture of varieties in the crop and, owing to the facility with which cotton plants cross-fertilise, considerable quantities of natural hybrids are produced which impair the homogeneity of the crop and the quality of the produce. This phenomenon is most evident in the

United States and is one of the principal causes of the deterioration of varieties of cotton plants and their low yield. An interesting study has been made on this subject in Texas by SAUNDERS and CARDON, and has shown that the mixture of seeds takes place in the case of the drum of ginning machines, that the ginned seed contains not less than 14 to 16 % of seeds from the lot of cotton previously ginned and that it contains also a small percentage of the previous lot.

To avoid this mixing the ginning apparatus must be carefully cleaned before proceeding to gin each new lot; these precautions require longer time which slightly increases the cost of the operation, but the advantages obtained are well worth the expense and result in an improved cotton crop.

Selection carried out by scientific methods is of very great importance for improving the seed. Researches on this subject have been undertaken for many years in British India at the experimental agricultural stations of Akola, Sindenahi, Ljallpur, Mirpurkas and in Burma. These researches have for object the isolation of the most productive and most important types, from an agricultural standpoint, from the mixtures of forms which constitute the local varieties or types and also the study of those exotic species which are most suitable for growing. The results obtained should encourage perseverance in this line and also might serve as an example to other Governments to carry out similar investigation and research in their countries.

The work of selection by pure lines carried out by B. C. BURT and HAIDIR NIZAMUDDIN at the Kaliempur Station (British Indies) and which deals with the type of acclimatised cotton plant known under the generic name of "Cawnpore American", may yield some important results. The quality and quantity of the produce in the selected forms have always been superior to that of the original mixtures and may open the way to further improvements.

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In Egypt, where the deterioration of cotton has been very marked in recent years, very searching investigations have been made regarding the causes of this deterioration which entails enormous economic injury to the country. The article by VICTOR MOSSERI on this subject, seems to be most interesting; he notes in Egyptian cotton plants, not a true degeneration, but a deterioration due to essential and accidental causes which affect the quantity and quality of the produce. To remedy it, especially so far as quality is concerned, it is necessary to isolate and purify the cultivated types or to select the most suitable plants and shield them during propagation from all other pollination.

Three methods can be used for this object — the first, employed by BALLS at the Laboratory of the Khedivial Society of Agriculture, consists, after having isolated a type, in adding, by means of crossing and methodical elimination, the advantageous specific characters desired. This

is the *method of addition or synthesis*. The second consists in isolating the types which present the specific advantages desired, eliminating those which do not offer the advantage wished for, the (*method of analysis or of elimination*). The third method is that of the *selection of advantageous mutations*.

The most difficult thing is to propagate the seeds of pure types and keep them free from all contamination, and this can be done by care when ginning; by not growing different varieties too near each other in order to avoid hybridisation, by eliminating undesirable plants from the plantation and by rigorous control of the seed. It is only in this way that the best Egyptian types can be saved from inevitable decadence.

This rapid study of cotton seed may be concluded by the following recommendations. —

1) That all cotton growing countries should carry out investigation and research on the genetics of local and imported species of cotton plants, following the methods used in India and Egypt, with the object of isolating the best pure lines

2) That, as soon as these pure types are obtained and established, every effort should be made to keep them free from all degeneration, especially by avoiding the cultivation of various species in adjacent areas.

3) The greatest care and cleanliness should be used in ginning cotton for seed purposes so as to avoid the mixture of seeds of different varieties, which takes place, as has been clearly proved, in the ginning machines.

### III. — DISEASES OF THE COTTON PLANT

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See also the collection of *Monthly Bulletins of Agricultural Intelligence and Plant Diseases* of the International Institute of Agriculture which contain, under the heading *Plant Diseases*, much information on the diseases of the cotton plant and their remedies

The cotton plant, like all cultivated plants, is subject to numerous diseases, some of which are very destructive to the crop. These diseases may be grouped in 3 classes. — The first includes those which are due to physiological causes, the second deals with diseases due to vegetable parasites, the third includes all diseases caused by animals, especially by insects.

#### (A) DISEASES DUE TO PHYSIOLOGICAL CAUSES

(a) "Mosaic disease or Yellow leaf blight". — This is characterised by yellow spots which are arranged more or less regularly on the surface of the leaves and cause withering and fall of the leaves. This disease

is often aggravated by the simultaneous attack of some fungus. It is due to the weak constitution of the plants attacked and the remedy lies in better cultivation such as the addition of kainit to the soil which is always beneficial

(b) "Red Leaf Blight" — This is shown by a red margin of the leaves; the growth of the plant is gradually arrested and the leaves fall. This disease is due to scarcity of some fertilising elements of the soil and can be controlled by means of manures, in order to supply the elements which are lacking (potash, nitrogen and phosphoric acid).

(c) "Shedding of Bolls". — Disease due to unfavourable climatic conditions and which is frequently noticed during periods of drought or excessive rain.

#### (B) DISEASES OF CRYPTOGAMIC ORIGIN.

(a) "Anthracnose". — This disease is caused by *Colletotrichum Gossypii*, and it attacks the stems and the leaves. No direct remedies against this disease are known; phosphate and potassic manures render the plants more resistant to attack. Where the disease has shown itself, all the refuse remaining in the field after the harvest should be collected and burnt and cotton should not be grown there in the following year.

(b) "Wilt or Trenching" is produced by *Neocosmospora vasinfecta*: the fungus enters the plant by its roots and gradually invades the whole vegetative system. The first indication of the disease is the turning yellow of the under part of the lowest leaves. On examination of the stem after breaking, it will be seen that the fibrovascular bundles are dark brown. The only remedy for this disease is selection, which enables resistant varieties to be obtained; in the United States the "Sea Island" cotton industry which was threatened with extinction, has been saved by this method.

(c) "Root Rot" is due to a species of *Ozonium*, a fungus which also attacks other plants besides cotton, such as lucerne, apple trees etc. The fungus attacks the roots and lives on the soil at the expense of the plant. The only means of control is a scientific rotation, by following cotton crops with cereals which are resistant to this disease; cotton should not be grown for three or four years on land where the disease has shown itself.

(d) "Cotton Leaf Blight" This is the most common disease of the cotton plant. The fungus (*Sphaerella gossypina*) usually attacks the oldest leaves and predisposes the plant to attacks by other diseases, particularly "Mosaic disease". The infected leaves are characterised by spots, white or light brown in the centre and reddish on the edges.

(e) "Cotton Mildew". Due to *Ramularia areola*, this disease shows itself on the leaves by small zones bordered by marbling.

(f) Angular Leaf Spot. — The disease is shown by dark angular spots on the leaves of the less vigorous plants; good cultivation is the best means of prevention.

*Heteroderma radiculicola* causes swellings on the roots and diseases of bacterial origin also attack the cotton plant.

### (C) DISEASES OF ANIMAL ORIGIN.

(a) "Cotton Boll Weevil" (*Anthonomus grandis*). This is the greatest enemy of cotton crop. This beetle, a native of Mexico was reported in 1892 in Southern Texas, and has spread to such an extent that it has invaded almost the whole cotton growing area, and causes enormous damage. The eggs are laid in spring on the flower buds or on the young capsules; the larvae feed on these parts of the plant and the insect multiplies so rapidly that five generations occur between the 1st May and the 1st December. Control by means of its natural enemies has been tried, among which are some hymenoptera (*Ectatomma tuberculatum*, *Braccon mollitor*, *Cotolaccus incertus*, *Eurytoma tylodermatis*, etc.) DWIGHT PIERCE has tried to limit the development by placing beside it other anthonomes but with little result.

Insecticides, arseniate of lead among others, have proved ineffective. The best means of control is to prevent the normal evolution of the species by adopting the following measures — (1) selection of varieties which ripen very early, (2) sow as early as possible, (3) hasten growth by all means. Furthermore, as the insect hibernates on the leaves and on debris of the soil, they should be burnt. Rotation also decreases the damage. In zones with a dry climate (East Texas, California, etc.) the plant is protected to some extent from the attacks of the "boll weevil".

(b) "Cotton Boll Worm" or capsule worm. This is the larva of a micro-lepidopter (*Heliothis armigera* or *Noctua armigera*) which is very common and feeds on the leaves, flowers and capsules of the cotton plant and causes great damage. As it also attacks other plant, it is recommended to sow catch-crops, especially maize sown late in the middle of the cotton fields to attract the insect at the time when the larvae develop. Insecticides made with Paris green and arseniate of lead have given good results. In Egypt the "Cotton boll worm" is the larva of *Earias insulana*, which behaves like the former and causes enormous damage, it also attacks hemp and *Hibiscus esculentus* (gombo, chindi) which is used in India as a trap-crop. An analogous species (*Earias tabia*) has been noticed in Egypt, India, Ceylon and Java.

The "Egyptian Boll Worm" is *Prodenia littoralis*.

(c) "Pink Boll Worm" or "small boll worm" is the larva of another micro-lepidopter very common in Europe, Asia and Africa (*Gelechia gossypiella*) which causes such great damage to cotton plantations that it destroys them completely, as has happened in India and in Egypt, where it is one of the causes of the decadence of cotton growing. The capsules attacked should be carefully collected and burnt, the use of lamps to attract and capture the insect, which is nocturnal, also gives good results. To destroy the larvae in the seed, which is the principal cause of propagation of the disease, the following methods may be employed:

1) treatment of the seed with hot air at 80° C ; (2) fumigation with bisulphide of carbon or hydrocyanic acid or sulphurous anhydride ; (3) immersion for 24 hours in a 0.1 % solution of "cyllin".

(d) "Cotton Worn" (*Alabama argillacea*) is another micro-lepidopter whose larva is a troublesome enemy of the cotton plant in the South of the United States and in the West Indies. This larva first attacks the topmost leaves and then descends towards the base of the plant destroying everything in its course, including young buds, flowers and young capsules.

In the United States good results have been obtained from an insecticide composed of powdered arseniate of lead mixed with Paris green, slaked lime and flour. In the West Indies the larva is destroyed by a wasp (*Polistes annularis* or "Jack Spaniard").

The "Leaf Roller" of different cotton countries is *Sylepta derogata*.

(e) "Cutworms" are the larvae of certain insects (*Feltia* sp., *Agrotis ypsilon*, etc.), which attack the young cotton plants after the germination of the seed. The best means of control is to place poisoned cabbage leaves in the infected plantations.

(f) "Cotton Aphid". This is *Aphis gossypii* which attacks a large number of young plants and the buds. The best remedy is the use of emulsions of soap and creoline.

(g) "Cotton Stainers". The worst are — *Dysdercus* (the American "red bug") and the *Pentatomia* (*P. ligata*), the "conchuola" of Mexican planters.

Locusts also cause much damage to cotton plantations.

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As is seen from this brief review, the diseases of the cotton plant are many and often very serious. To control them it is indispensable to take international and national measures. These measures should prohibit the transport of seed of infected regions, unless disinfected and carefully controlled, into regions free from disease, methods of control should be studied and the most resistant types should be selected. It has been proved, for instance, that the resistance of Indian cotton plants to certain parasites is due to abundant resinous secretions which cover the valves of the capsules. This course, namely the study of types resistant to and free from disease, which has already given such excellent results with cereals for resistance to rust, will give important results provided that the investigations are undertaken with adequate means and a clear idea of the ends to be attained.



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SECOND PART  
A B S T R A C T S

AGRICULTURAL INTELLIGENCE

CROPS AND CULTIVATION

798 - **Phenological Observations in Holland in 1921.** — Bos, H., in *Cultura*, Year 34, No. 400, pp. 2-13. Tiel, Jan. 1922

AGRICULTURAL  
METEOROLOGY

Results of observations made in 1921 at the stations organised by the writer in Holland. Noticeable points:—

(1) The great abundance of flower buds of the ash (*Fraxinus excelsior*);

(2) The severe frost ( $-7^{\circ}\text{C}$ ) of 15th-16th April which damaged the flowering of cherry and pear trees and destroyed the shoots of acacias and plane trees;

(3) The early flowering and ripening, 10 days earlier than usual, of autumn rye;

(4) The severe drought in spring-summer caused a series of interesting phenomena: --- there was a partial fall of leaves in the summer, followed, in certain plants (*Syringa*, *Jesulus*, etc.) by a fresh foliation and flowering; pear and apple trees blossomed for the second time at the end of June and commencement of July, and produced, generally, fruit half the size of normal fruits, but which in some cases attained remarkable size; most of them had no pips.

The drought also caused the leaves to turn yellow and wither, but this phenomenon should not be considered as an anticipation of the normal process of fading and fall in autumn. This process in fact, took place as usual in autumn, but notably late, due, according to the writer, to excessive exposure to the sun.

G. A.

799 - **Data regarding the Distribution and Intensity of Hail in Bulgaria.** — GREGOROV, G. in *Semkdelie*, year XXV, part 8, pp. 121-122. Sofia, Aug. 1921.

Data collected during the decennial period 1911-1920 warrant the statement that the greater part of Bulgarian territory is subject to frequent and severe hailstorms. The phenomenon has an essentially local character; cases however of extensive hailstorms, such as that of the 18th June, 1915, which raged over 164 communes, are not lacking. In most

[Abstract No. 798-799]

*Distribution of hail in Bulgaria.*

Year	Date of the first hail	Date of the last hail	Duration of the hail Season	Maximum quantity of hail		Number of days on which hail fell	Number of Communes in which hail fell					
				Date on which it fell	Number of communes in which hail fell		Total	Once	Twice	Thrice	Four times	Five times or more
1911	3 III	27 IX	200	15 VI	15	29	108	89	16	3	—	—
1917	27 IV	27 IX	154	9 VII	52	39	281	232	38	8	2	1
1913	22 IV	1 IX	131	10 VI	70	55	352	264	61	17	8	4
1914	3 V	9 IX	130	3 VI	90	63	441	315	94	23	5	4
1915	14 IV	23 IX	162	18 VI	164	60	455	328	81	36	6	4
1916	25 IV	23 IX	151	13 VI	93	65	470	358	148	43	13	9
1917	19 IV	30 VIII	134	18 VII	60	49	281	227	47	5	2	—
1918	23 IV	10 IX	141	27 VII	57	47	369	302	54	11	2	—
1919	9 IV	18 X	193	25 VII	43	54	322	257	50	11	3	1
1920	24 IV	7 IX	137	19 VII	49	54	316	245	44	17	8	2

cases the hail clouds come from the west or north-west, and the phenomenon ordinarily is seen between 2 p. m. and 6 p. m.; it is very rare in the morning, the evening and at night.

The annexed Table contains the following data:— 1) duration of the hail season; 2) number of days on which hail fell; 3) number of communes in which hail fell, on the average, once, twice, or more often.

During the period dealt with, the duration of the hail season was 154 days (5 months). There were, on the average, 52 days of hail, and hail fell in 340 communes or  $26\frac{3}{4}\%$  of the insured communities. The co-operative Bank had to indemnify 18% of the insured (47 166) and pay 17 997 416 lei ( $9\frac{33}{64}$  pence at par). G. A.

## SOIL PHYSICS

800 — **The Soil Fauna of Agricultural Land.** — BUCKLE, P. (Department of Agricultural Entomology, Victoria University of Manchester), in *The Annals of Applied Biology*, Vol 8, Nos. 3-4, pp. 135-145, bibliography of 10 works. London, November 1921.

It is well known that cultivation has a detrimental effect upon the soil fauna, and various cultural operations are strongly advocated as preventive and remedial measures against the depredations of soil insects. However, it is not known whether arable land possesses a characteristic fauna apart from species peculiar to certain crops.

Hence, the survey was carried out on three types of agricultural land and the author studied the fauna of: a) land continuously under the plough for a number of years; since 1916, the rotation of crops included oats, potatoes, turnips and mangels and wheat; a dressing of farm-yard manure was given preparatory to the root-crop; 2) pasture land that had been broken up not less than three years previously; 3) permanent pasture, or meadow-land. The author gives all the characters of these

three types. In studying the fauna, 9-inch cube samples were used; the soil was allowed to dry and then passed through sieves of different degrees of fineness. The arthropoda thus collected were carefully classified. The researches lasted from October 1919 to May 1920; during this time viz., nine months, the soil fauna were more stable and numerous on the grassland than on the arable land, probably because grassland bears a vegetative covering, while little if any vegetation exists on arable land; further, the ploughing and working of the ground brings the fauna to the surface and exposes the animal life, not only to bird attack, but also to harsh climatic conditions, especially in the winter and early spring, thus disturbing many hibernating species. There was a corresponding increase in the fauna on all the three types of land as the vegetative growth increased. No characteristic fauna of arable land could be discovered; the predominant species were those commonly found on pasture.

The author has, however, not made any quantitative determinations, as these investigations are of a preliminary character. L. V.

801 - **Influence of Salts on Bacterial Activities of Soil.** — GREAVES, J. P. in *The Botanical Gazette*, vol. LXXIII, No. 3, pp. 161-180, bibliography of 29 works. Chicago, March 1922.

A study has been made of the influence of 24 salts on soil microflora and the minimum amount of solution required to effect certain forms of bacterial activity, such as ammonification, nitrification and nitrogen fixation. The results are tabulated clearly, showing the six cations of the different salts employed and the 4 anions and the measure of toxicity of the resulting 24 salts.

As regards ammonification, the maximum retarding effect was noted with potassium chloride and sulphate of iron (vol. mol. =  $625 \times 10^{-7}$ ); then in order of sequence is placed calcium chloride and magnesium nitrate ( $156 \times 10^{-7}$ ) etc. The toxicity of a compound is regulated by both anion and cation; almost without exception the chlorides are more toxic than the corresponding nitrates. The sulphate varies according to the cation with which it is combined. The relative toxicity for the anions can be written as follows:  $\text{Cl} > \text{NO}_3 > \text{SO}_4 > \text{CO}_3$ , and the results for the cation:—  $\text{Mn} > \text{Mg} > \text{Fe} > \text{Ca} > \text{Na} > \text{K}$  or the monovalent anion is more toxic than the bivalent and viceversa for the cation.

Results obtained with nitrification indicate that the nitrifying organisms are more sensitive than the preceding; toxicity of salt increases with concentration much more rapidly than in the case of the ammonifiers:—  $\text{CO}_3 > \text{NO}_3 > \text{SO}_4 > \text{Cl}$ ; and of the cations  $\text{K} > \text{Mg} > \text{Fe} > \text{Mn} > \text{Ca} > \text{Na}$ .

As regards nitrogen fixation, the organisms concerned, are on the contrary very resistant, so that the concentrations employed were hardly ever strong enough to act as a retarding agent; the results do not therefore allow any definite conclusions to be drawn as to the degrees of toxicity of the various salts.

It appears, however, that toxicity is due in a large measure to osmo-

tic influences. Thus with 24 salts, 16 became toxic when the osmotic pressure ranged between 1.43 and 1.96 atmospheres. But other factors intervene; for example the range of toxicity for cations on ammonification organisms shows a similarity to that due to protoplasmic formation; it is very probable that the cations modify the proteins forming the protoplasm and in such a way as to incapacitate them for their normal functions.

All except 6 of these salts acted as stimulants of bacterial activity, measured by the quantity of ammonia, nitrates and nitrogen fixation.

In the investigations made on bacterial activity it was discovered that assimilation of part of the organic material occurs. This influence is well indicated in the solubility of the rock phosphate; to identify the changes due to bacteria, organic phosphorus has been treated with water-soluble phosphorus. The results obtained show that certain salts, for example manganese carbonate, increased bacterial activity (135.1 % compared with the control), whilst with others such as magnesium carbonate a contrary effect was obtained (85.1 %).

L. V.

**802 - Influence of *Azotobacter* added to the Soil on the Plant-growth. —**

FOUASSIER, M. and L'HOMME, J., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol 8, No 7, pp 155-159 Paris, Feb 15, 1922

The writers recall that since 1877, SCHLOESING and MUNTZ, on the basis of Pasteurian ideas, had shown that the processes of nitrification of nitrogenous matter are in correlation with the existence in the soil, of living agents, whose action is arrested by sterilising agents such as chloroform or heat. Later nitrification and the fixing of nitrogen were the object of researches on the part of BIRTHLOT, JOULIE, A. GAUTIER, BRÉAL, ANDRÉ, etc. In 1893 WINOGRADSKY noted the symbiosis of Leguminosae with the nitrogen-fixing microbes, later he isolated one of the most active agents of this phenomenon, the *Azotobacter*, DÉHÉRAIN studied the action of *Azotobacter* on the soil in different conditions.

Meanwhile, methods were sought for favouring the multiplication of nitrogen-fixing microbes in the soil, for increasing their power, and for determining their solution by means of suitable sterilisation. LAPPARENT and RABATÉ observed that by spraying the soil with a  $\frac{1}{10}$  solution of sulphuric acid to the extent of 1 cub m per hectare an increased crop was obtained. In America and England sterilisation of the soil is practised in market gardening. In France TRUFFAUT and BEZSSONOFF after having studied the action of aromatic carbides fixed on calcium sulphide as sterilising agent.

The writers have made similar experiments, but for sterilisation they have used formol in doses of 3.45 per cub. m.; they abandoned the use of calcium sulphide because TRUFFAUT, who had recognised it as one of the best soil sterilisers, had also proved that the sulphur in its composition is a fertiliser. As nitrogen-fixing agent the writers used *Azotobacter agilis*, isolated to a pure state, and then cultivated in non sterilised, aqueous extract of earth, to which a little glucose was added: in this non-nitrogenous medium the *Azotobacter* soon got the upper hand while the other

germs perished. The experiments were made on 5 plots of ground in the open field, 1 sq. m. each and arranged in a similar way: one remained as control plot, two were sterilised, two not; in the case of each of these two pairs, to one plot was added mould containing 1.5% of organic nitrogen; 24 hours after sterilisation broadcast sowing was made with clover seed; then over all the plots, except the control plot, the liquid containing the *Azotobacter* was poured using  $\frac{1}{4}$  of a litre per sq. m., diluted with 5 litres of ordinary water. The differences in growth, at first imperceptible, became well marked towards the 20th day in favour of the *Azotobacter*, it is strange to record that the growth was greater in the sterilised plot to which no mould was added. Without wishing to exaggerate the importance of these researches, the inference is that *Azotobacter* is able to cause the fixation of nitrogen even if it is added directly to the soil L. V

803 - **Nitrogen Fixation in Ericaceae.** - RAYNER, M. C., in *The Botanical Gazette*, Vol. 73, No. 3, pp. 226-235, figs. 4 Chicago, March 1922

The article gives a general review of the subject together with some new data.

It has been known since the middle of the nineteenth century that plants belonging to the Ericaceae form characteristic mycorrhiza, but it is only recently that some light has been thrown upon the relations between the plant-host and the endophyte.

In 1907 TERNETZ succeeded in isolating from the roots of certain Ericaceae several pycnidia-forming fungi which were all referred by LINDAU and HEMMINGS to the genus *Phoma*. They differed from the species previously found associated with Ericaceae in the small size of their pycnidio-spores, and though isolated from plant species growing in close proximity, are specific strains, distinguishable by definite morphological and physiological characters. The most distinct forms were named *Phoma radialis Ericae*, *Ph. r. Tetralicis*, *Ph. r. Vaccini*, *Ph. r. Oxycocci*, *Ph. r. Andromedae* respectively. It should be noted that the isolation of fungi endophytic in the roots of plants is very difficult, and the identity of the fungi can only be proved by inoculation from pure culture into the roots of sterile seedlings and the consequent formation of the mycorrhiza typical for the species. TERNETZ's work in this connection is open to criticism, for he never succeeded in obtaining sterile Ericaceae seedlings, and hence there was no proof that the mycorrhizal condition was due to the inoculated fungi.

TERNETZ also tried to discover whether the *Phomae* he had isolated could fix atmospheric nitrogen. He therefore cultivated them in nitrogen-free media with all due precautions as to purity of materials, adequacy of controls and methods of estimation. The cultures were carried over a period of several years, and frequently repeated. It was found that none of the five strains investigated required a supply of combined nitrogen for healthy development or growth. They all fixed atmospheric nitrogen, but in very different degrees. From his own comparative experiments, which agreed in this respect with the results obtained by other investi-

gators, TERNETZ found that the strains of *Phoma* are much less energetic nitrogen fixers than *Azotobacter chroococcus*, *Clostridium pasteurianum* and *C. americanum*, but more economical as regards the amount of dextrose consumed to obtain the energy necessary for the process; for example, the maximum amount of nitrogen combined for each mg. of dextrose used by them was 22 gm. as against 10.6 gm. in the case of the nitrogen-fixing bacteria. The values obtained for *Aspergillus* and *Penicillium* were too small to have any serious value.

In ignorance of the work of TERNETZ, the author made an exhaustive experimental study of an Ericacea, *Calluna vulgaris* and published the results in 1915. He showed that the fungus is already present in the testa of the seed and infects the young seedling immediately after germination. A pycnidia-bearing fungus was eventually isolated with comparative ease from unopened fruits. Proof of the identity of this fungus was provided by reinoculation into seedlings raised from sterilised seed. The author tried to detect the symbiotic relation between *Calluna* and the endophyte, and found that the former could not grow in a sterile medium, thus proving that a remarkable case of *compulsory symbiosis* existed between the two organisms. The hyphomycete is distributed throughout the plant tissues of the host including the seed-coat and eventually reaches the ovary; the mycelium spreads to the seed-coat, so that the seedling become infected. Root-formation by the seedlings is dependent upon early infection by the endophyte; if this does not take place, development ceases and the young plant perishes. It is probable that the same conditions exist in the whole family of Ericaceae and in fact ovarial infection has been reported for many species, and the inability of seedlings to complete their development without infection has already been proved in a number of cases.

Similar conditions are also to be found among the Orchidaceae, but here the endophyte is localised in the root-cells, so that the infection of the seedling is not insured. There is visible evidence in orchids of the digestion of the mycelium by the cells of the root, and it is clear that by this means the plant can draw indirectly upon organic compounds of carbon and nitrogen in the soil.

In the chlorophyllous orchids the endophyte can utilise the products of photosynthesis, otherwise the higher plant lives as a parasite at the expense of the fungus. This condition has been fully demonstrated for *Gastrodia elata*, a Japanese orchid, parasitic upon a fungus, *Armillaria mellea*. It is certain therefore that one at least of the so-called "saprophytic" orchids is to a certain extent parasitic. This is the more interesting because the fungus in its turn has parasitic habits and invades the tuber of the orchid in the first instance in exactly the same manner as it attacks the tubers of the potato, it is only afterwards that the fungus supplies the orchid with food. These facts explain the ecology of *Calluna*. There is no indication in this Ericacea of digestion of the *Phoma* mycelium by the root, nor are there any obvious symptoms of attack or defence beyond the fact that the hyphae effect an entry and spread from cell to cell. It is

only in the mesophyll cells of the leaf that the mycelium undergoes digestion. The mycelium in its turn draws its supply of organic compounds from its host ; as is proved by the cultures in solutions of mineral salts and the power it possesses of hydrolising arbutin. This being so, the question of the use of the endophyte to the Ericaceae naturally presents itself. There is abundant evidence that the fungus can fix atmospheric nitrogen in a greater or less degree and supply it to the host in return for the organic compounds it obtains from the host. Of this fact the following proofs have been obtained : 1) infected *Calluna* seedlings, germinated on filter paper moistened with distilled water are vigorous and longlived ; 2) the endophyte is widely distributed through the plant tissues, develops in the intercellular spaces of the leaves and emerges into the air from the surface of the shoot, as if to obtain nitrogen from the atmosphere ; 3) the mycelium is afterwards digested by the mesophyll cells in which the fixation of oxygen takes place. On the other hand there is no evidence that the endophyte of Orchideae can absorb atmospheric nitrogen, for it does not spread into the chlorophyllous tissues

In 1916, DUGGAR and DAVIS made an experimental survey of previous work on nitrogen fixation by fungi and extended the observations of earlier investigators, taking special precautions to avoid dubious experimental methods. They tried many species and varieties of fungus, among which was *Phoma Betae* which has the power, common to all the *Phomae*, of fixing atmospheric nitrogen. In this manner an indirect proof of nitrogen fixation on the part of Ericaceae by means of endophytes was obtained

The author has recently provided a further experimental proof. He has already grown two sets of *Calluna* seedlings, the one in agar-agar free from combined nitrogen, and the other in the same medium, but with the addition of a 0.5 % concentration of potassium nitrate as being the solution most suitable for the purpose. No special precautions were taken beyond the use of pure chemicals and freshly distilled water. The seedlings grew equally well in both cases, and those not supplied with nitrate were of a brighter green.

The experiments have since been repeated using every possible precaution to avoid contamination by traces of combined nitrogen. A similar solution of inorganic salts was made up in silica jelly prepared from specially purified materials and ammonia free water. The results obtained confirmed those already described, although owing possibly to mechanical difficulties offered by the silica jelly, the seedlings did not take root freely.

It may be objected that the seeds used their reserves of nitrogen, but when sterilised seeds were employed and no nitrates given, the seedlings turned yellow and the leaves became discoloured, these symptoms being relieved by inoculation with a pure culture of the endophyte. The fixation of nitrogen by Ericaceae through the medium of species of *Phoma* has thus been clearly demonstrated and with their aid Ericaceae can grow and thrive in soils deficient in nitrogen.

These researches have in part been carried out at the Pilcher Research Laboratory, Bedford College, University of London.

L. V.

804 - **The Micro-organisms of Sulphofication** (1). - I WAKSMAN, S A (New Jersey Agricultural Experiment Station, Department of Soil Chemistry and Bacteriology), Micro-organisms concerned in the Oxidation of Sulphur in the Soil, I. Introduction, *Journal of Bacteriology*, Vol VII, No 2, pp 231-238 Baltimore, March 1922 — II WAKSMAN, S A, and JOFFE, I S (Id) Id, II. *Thiobacillus thiooxidans*, a New Sulphur Oxidising Organism isolated from the Soil, *Ibid* pp 239-256, figs 2, 1 pl, bibliography of 36 works

The micro-organisms of sulphofication have been very carefully studied by OMELIANSKY, DUGGELLI, and KRUSE. The author takes up the subject with the object of establishing the present state of knowledge of the question and of using the data collected as a starting point for further investigation

Hydrogen sulphide, sulphides and thiosulphates undergo a spontaneous oxidation process resulting in the separation of sulphur. The sulphur thus produced, like natural sulphur, if finely subdivided, is further oxidised with the production of sulphuric acid; the latter, reacting with carbonates and other salts, forms sulphates

The process takes place very slowly as a result of the action of simple physical and chemical forces, but is greatly accelerated by specific bacteria; this was pointed out for the first time by WINOGRADSKY who referred to them under the name of *sulphur-bacteria*. In the transformations which sulphur and its compounds undergo, two types of bacteria are concerned, the one being a reducing, the other an oxidising agent. The sulphur-bacteria belong to the second class and are very energetic in their action. The first sulphur-bacteria studied by WINOGRADSKY contained granules of sulphur resulting from the oxidation of the hydrogen sulphide dissolved in the medium, subsequently, many other micro-organisms were found to possess the power of oxidising hydrogen sulphide, sulphides, thiosulphates and sulphur, some of them being able to accumulate sulphur in their cells. These microorganisms are very heterogeneous in character.

In nearly all the work which deals with the oxidation of sulphur by bacteria the point of departure of the process was not regarded as sulphur, but as hydrogen sulphide, sulphides and thiosulphates, the oxidising power of these bacteria not being estimated by the oxidation of the sulphur and hence by the production of sulphuric acid and sulphate or the change in the reaction of the medium, but only by the appearance and disappearance of the granules of sulphur. This was due to the fact that the sulphur-bacteria were studied in sulphur springs, mud baths, sea-water, drinking-water and drainage-water, very little attention being paid to the micro-organisms that oxidise the sulphur of the soil. It was only later that these micro-organisms aroused interest, as a result of the researches of JACOBSEN and other writers. It has also been recognised that the oxidation process takes place in two stages; the sulphur is produced first and afterwards transformed into sulphuric acid. Two large classes of micro-organisms are

(1) See R 1919, No 693 (Fd)



especially concerned in the work. The bacteria of one class oxidise the hydrogen sulphide, sulphides and thiosulphates removing the sulphur which they accumulate internally and subsequently oxidise. These bacteria cannot oxidise external sulphur, and are therefore of little importance as regards the chemical changes which take place in the soil; they have, however, been more completely studied than the bacteria of the second class. These are either unable to bring about the preliminary changes, or can only carry them out unsatisfactorily; they alone, however are, capable of oxidising external sulphur. These bacteria are the more important to agriculture, but scientific knowledge of them is still incomplete.

Each of the two large classes can be further subdivided into smaller groups according to their morphological characters and physiological properties. The micro-organisms capable of storing up sulphur in their protoplasm consist of 3 groups: 1) colourless and filamentous; 2) colourless and non-filamentous; 3) purple rhodobacteria. The micro-organisms that cannot accumulate sulphur within themselves, but are able to oxidise external sulphur, can be divided into 2 groups according as: 1) they themselves deposit the sulphur externally and separate it from the other compounds; 2) they do not deposit sulphur. The latter group is the more active. There are thus 5 groups of sulphur-bacteria each of which can be studied separately.

1st GROUP. — This is the best-known, for it has been the longest investigated. It includes three genera; *Beggiatoa*, mobile forms of bacteria; *Thiothrix*, immobile forms of bacteria (both of these have no sheath), and *Thioploea* composed of bacteria covered with a gelatinous sheath. The *Beggiatoa* are the classic sulphur-bacteria. As long ago as 1870, CRAMER recognised that the granules they contained were sulphur; later, COHN was of opinion that the *Beggiatoa* and the purple bacteria reduced the sulphur they contained and produced hydrogen sulphide. WINOGRADSKY subsequently showed that exactly the opposite process takes place, the sulphur accumulated in the protoplasm of these bacteria which is present in the form of soft globules incapable of cry-tallisation is the product of the oxidation of hydrogen sulphide; when subsequently oxidised, it produces sulphuric acid, which is neutralised by the carbonates and bicarbonates, and liberates carbon dioxide; hence the medium never becomes acid. These processes are exothermic, that is to say they entail a certain production of heat, thus supplying the bacteria with the energy they require for living and building up their organic substance. If these micro-organisms are deprived of hydrogen sulphide, they burn up all their accumulated sulphur and then perish. Traces of nitrates or of other simple nitrogenous substances are all they need for the construction of their plastic materials, but peptone, sugar, etc. which promote the growth of other bacteria are useless or injurious to *Beggiatoa*. KEIL believes himself to have obtained pure cultures of *Beggiatoa* and *Thiothrix*. He clearly recognised that both species can live in media containing no organic matter, for which reason he called them autotrophic. KEIL showed that these bacteria can obtain from carbon dioxide all the carbon they require for

the formation of organic matter, and he states that the presence of carbonates is necessary for the neutralisation of the sulphuric acid. The different species of *Thioploea* have been studied by WISLOCK and by KOLKWRZ.

2nd GROUP. — This is very heterogeneous and artificial. It contains most dissimilar forms, bacilli like *Thiobacterium*  $\alpha$  and *Thiobacterium*  $\beta$  described by JEGUNOW; spirilli like *Spirillum agilissimum* and *Microspira vacillans* described by GICKLEHORN, and even flagellates like the *Monas Mülleri* of HINZE.

3rd GROUP. — The rhodobacteria are characterised by two pigments distributed irregularly throughout their protoplasm: bacterio-purpurin, which is red, violet-red, or brownish red, and bacterio-chlorine which is green. Although these micro-organisms occur in large numbers in the water of sulphur springs and in mud impregnated with sulphur, they are unable to isolate the sulphur present. MOLISCH succeeded in obtaining pure cultures of some of these forms, but they were not sulphur bacteria. According to MADSEN and MOLISCH, sulphuric acid is not necessary to keep them alive, and they contain no sulphur granules; this statement, however, does not agree with the preceding observations made by WINOGRADSKY and others. The behaviour of these bacteria as regards sulphur is therefore an open question.

4th GROUP. — The bacteria composing this group were observed for the first time in sea-water by NATHANSON and subsequently found in drainage water, and in the soil. They oxidise hydrogen sulphide, sulphides and thiosulphates and accumulate sulphur externally forming a thick surface film containing sulphur which they can ultimately break through. The bacteria of this group are also able to use the carbon of carbon dioxide for the manufacture of organic matter. NATHANSON has cultivated them in liquid media containing, amongst other substances, thiosulphates and carbonates; BEIJERINCK has generally confirmed these results, and recognised that no other source of carbon is capable of replacing carbon dioxide. He isolated a very mobile, non spore-forming type of *Thiobacillus thio-parum* and a very similar form of *Bacillus denitrificans*, capable also of liberating the nitrogen of nitrates. JACOBSEN has carried out some quantitative experiments to determine how far *Thiobacillus* is able to oxidise external sulphur. LIESKE and GOEHRING have found *Bact. denitrificans* in many soils, while GICKLEHORN has met with bacteria of the same group in garden mould, but has never isolated them.

5th GROUP. — Although the first four groups are well-known and have been described in microbiological treatises and in special studies on sulphur-bacteria, little attention has been paid to this last group, although it includes some of the bacteria that are most active in oxidising the sulphur of the soil. These are very common in soils to which crude sulphur has been added, and they obtain from it large quantities of sulphuric acid. The bacteria of the 5th group also oxidise thiosulphates to a slight extent, but cannot break up hydrogen sulphide or sulphides, and do not liberate sulphur, they form no surface film on the liquid on which they are growing, but are distributed equally throughout the mass; they extract all the car-

bon from carbon dioxide. These micro-organisms, though excessively minute, are the most active sulphur oxidising agents and acid producers known. The group has but one representative *Thiobacillus thioxydans*, which is very common in the soil, and has been the object of preliminary studies on the part of the author in collaboration with JOFFE and LIPMAN.

II. — In a mixture of soil, mineral phosphate and sulphur, the sulphur is quickly oxidised into sulphuric acid, which converts the basic lime phosphate into neutral phosphate, then into acid phosphate and finally, if the phosphate supply is exhausted, it accumulates it on its own account unaltered. These facts were discovered by MACLEAN in 1918.

The authors have succeeded in isolating from the mixture a micro-organism which oxidises sulphur. They employed the dilution method, adding to the substance sterilised water in the proportion of 1 : 10 up to 1 : 10 000 000 ; and then added 1 cc. of the liquids thus obtained to 100 cc. of the cultural medium. This consisted of a suspension-solution in distilled water, of sulphur (1 %), basic phosphate of lime, ammonium sulphate and other mineral salts. The authors also tried adding glucose, but had to abandon it, as this carbohydrate encouraged the growth of moulds. By means of successive transplanting the cultures became gradually purified, as was ascertained under the microscope, and proved by the sterility of cultures grown in ordinary nutritive media.

The micro-organism isolated is a very minute bacterium with rounded extremities, gram positive, and non-spore producing ; most of the individuals measure 10.5  $\mu$ . In its morphological characters it much resembles the two species of *Thiobacillus* identified by BEIJERINCK. For this reason, the authors have included it in the same genus under the name of *Thiobacillus thioxydans* n. sp. ; it is however very different in its physiological behaviour, and has therefore been placed in a separate group. Unlike the two forms separated by BEIJERINCK, which liberate sulphur from hydrogen sulphide, sulphides and thiosulphates and deposit it externally, the new bacillus only attacks thiosulphates, and does not deposit sulphur, but oxidises the surrounding sulphur.

From sulphur, *Thiobacillus thioxydans* obtains all its life-energy. Its activity can be accurately gauged from the amount of sulphur oxidised ; the quantity of sulphuric acid thus produced, or the amount of basic calcium phosphate dissolved by this sulphuric acid. Impure cultures have proved the more active ; they have oxidised as much as 20-30 % of the sulphur. The original acidity of the cultural medium was  $\text{pH} = 5.6-6.2$  ; during the growth of the culture, it continually increased up to 2.8-2.6 where it remained stationary (this being the optimum growth acidity), until all the tricalcic phosphate had been dissolved by the sulphuric acid and transformed into bicalcic phosphate, monocalcic phosphate and phosphoric acid, the calcium being however precipitated in the form of the sulphate. The further oxidation of the sulphur resulted later in the production of free sulphuric acid which increased the acidity, the latter reaching values of pH ranging from 1 — 0.8 — 0.6. This high acidity hindered the further development of the culture, producing an auto-regulation of the acid content. If

much tricalcic phosphate was present, a larger amount of sulphur was oxidised, because the acid produced could be neutralised during a longer period without impeding the growth of the culture. An excess of tricalcic phosphate (as well as of carbonates), was not, however, easily tolerated.

The micro-organism obtains all its carbon from the carbon dioxide of the atmosphere. It has no need of carbonic acid obtained from carbonates by the action of sulphuric acid; carbonates never increased its growth and sometimes they were even found to hinder it, as occurred when the medium was rendered alkaline. The reason is that sulphur-oxidising bacteria prefer an acid medium, whereas nitrifying bacteria flourish in an alkaline medium. Bi-carbonate of sodium is not only useful to the nitrifying micro-organisms as affording a supply of carbon, but also and chiefly, because it renders the medium alkaline (MEYERHOF). For the same reason it may have an injurious effect on sulphur-oxidising bacteria. The latter are not tolerant of calcium oxide, for it has the power of producing too sudden a change in the reaction of the medium, whereas tricalcic phosphate is very useful in neutralising the sulphuric acid formed, owing to its insolubility and the acid compounds and insoluble deposit to which it gives rise.

The best source of nitrogen proved to be the inorganic salts of ammonium, but other compounds can also be used.

In conclusion, *Thiobacillus thioxydans* (which is doubtless the first recognised individual of a group of energetic sulphur-oxidising bacteria), is distinctly autotrophic, that is to say able to live and grow at the expense of organic matter alone; it derives its energy from sulphur, the carbon present in carbon dioxide, and the nitrogen of mineral salts. Glucose is not injurious to the bacterium, but has no effect upon the production of sulphuric acid. Autotrophic microorganisms possessing the power of manufacturing organic matter from mineral substances in the same manner as higher plants, but without the aid of sunlight, or chlorophyll are not only of considerable agricultural importance, but also of great general biological interest, as probably being the earliest representatives of organic life upon the globe.

L. V.

805 - **Researches on the Efficacy of Deep Tillage and on the Distribution of the Roots of Certain Plants in Different Strata of Soil.** — AVANZI, E. (Istituto agrario della R. Università di Pisa), in *L'Agricoltura Italiana* Year XLV, parts 1-3, pp 41-56 Pisa, 1922.

Preliminary researches commenced in May 1920, with the object of determining the influence which the depth of preparatory tillage might have on different crops grown in succession on the same soil. In a preliminary experiment frames 10 cm. in height were placed one on top of another and sunk on garden soil normally dug with the spade; each series of 5 frames was filled with soil which had been dug over and exposed to the sun. An analysis of the soil was made and the fundamental manuring consisted of mineral superphosphate and nitrate of soda; buckwheat and millet were sown in two series, succeeded by autumn wheat and white

mustard; the second season was particularly dry, for which reason the humidity of the different boxes and the different strata of soil was determined at the end of the experiment.

It is easily understood, after what has just been stated, that the results of the researches made cannot be applied in practical cultivation. However, these researches allow certain conclusions to be drawn which confirm the general rules regarding the influence of the depth of tillage in regard to different crops.

If the produce obtained with the various plants used in the experiment is examined, it is noticed that the increased production due to greater depth of tillage was realised, as is easily supposed, with the crops which were formed immediately after the execution of the tillage. It is next noted that the increased production has not taken place in proportion to the depth of the tillage, since this increase after reaching its maximum for the first deepening of the tillage (from 10 to 20 cm), has then become less accentuated, and, after having attained a maximum, instead of continuing to grow in proportion to the depth, has, on the contrary, decreased in a sudden and marked manner; and it has done so very probably owing to the intervention of injurious actions exercised by the mineral and organic matter situated in the deep strata and brought to the superficial strata. It is further remarked that the favourable effect of deep tillage was particularly manifest with millet, which, on account of its great vegetative activity and its rapidity of growth, consumed a greater quantity of fertilising substances and water for the production of a much greater quantity of organic matter than that produced by the buckwheat. The crop of wheat which followed that of millet and buckwheat also felt the effects of the different depth of tillage previously done, but the effect in its case was much less; to such an extent that if there was a noticeable increase in the production of grain there was often a reduced production of straw.

Another fact which this crop has brought into prominence concerns the slightly smaller quantity of grain obtained from the wheat which followed the millet compared with that yielded by the wheat which followed the buckwheat. The white mustard, having gone through a period of scarce rainfall, felt the effects of the tillage also in a notable manner, and its increased production was similar to those recorded for the former crops.

A final remark concerns the smaller amount of humidity in the upper layer of soil where the tillage was only 10 cm, in comparison with the humidity contained in the soil of the corresponding layers where the soil had been more deeply turned up; and this will seem all the more remarkable if it is remembered that in the former case there was also a smaller consumption of water, owing to the smaller amount of organic matter produced.

Other researches on the distribution of the roots of certain crops in the different layers of soil accompanied the former; they were made with rules and methods similar to those above mentioned, with this difference

that the frames were 15 cm. high. In five parallelepipeds of soil formed of five frames superimposed, indigenous selected maize, millet, hemp, giant sunflower, and Kentucky tobacco in transplants were sown on the 25th May 1920. The vegetative phases passed regularly and, in October when each species had finished its vegetative cycle, the roots were examined.

The writer concludes from that examination that the greater part of the root-system of the species considered was found in the most superficial part of the soil, to the extent that about 90 % of the weight of the roots are in the first 23 cm. of depth. However, it should not be forgotten that a good part of the weight of the roots found in the upper layers is constituted the taproots or by the thickest roots while the deeper layers only contain the capillary roots.

As is easily supposed each plant is distinguished by a characteristic root system. Maize has strong principal roots to which are attached numerous capillary roots, very largely found in the first and second layers.

Millet has a root-system very similar to maize ; but it is much more abundant and formed of more resistant and more pliable roots.

Hemp has a root-system which may be considered as typical of plants with tap-roots : from the taproots start more or less stout secondary roots to which are attached the system of capillary roots formed of very fine rootlets. The sunflower is indicated, as is well known, as a taprooted plant : it has, it is true, a very strong taproot which buries itself beyond the third layer ; but, differing from true taproots, it has a capillary system of very fine rootlets which spreads out mainly in the more superficial layer.

Tobacco, owing to transplantation, has not a true taproot, since at a depth of a few centimetres (4 to 6) the taproot is replaced by very strong secondary roots spreading chiefly in the lower layers and bearing capillary rootlets which reach a considerable depth.

The form and distribution of the root-system may serve to justify the various exigencies of plants in the matter of soil, preparation, tillage, manuring and cultural care. In any case, we should never neglect the direct or indirect influences which tillage exercises on the physical, chemical, and biological properties of the soil and which are expressed by greater or less vegetative activity of the plants cultivated.

Another fact, which we must beware of neglecting in the matter of tillage and manuring concerns the rate of growth of the root-system ; it probably is very different in various plants. In fact, the above-mentioned researches have given prominence only to the final conditions, but it would not be without importance, especially in connection with the application of quick acting manure, to follow the development of the root-system of different species of plants in their most typical vegetative phases.

G. A. B.

806 - Application of Electricity to Cultivation. - See Nos. 814 and 867 of this *Review*.

807 - **The Effect of Gypsum on Soil Reaction.** — ERDMAN, I. W. (Iowa Agricultural Station) in *Soil Science*, Vol. 12, No. 6, pp 433-448, bibliography of 32 publications. Baltimore, Dec. 1921.

Gypsum has been used as a fertiliser for many years and has often proved to be valuable when applied to small grains and clovers.

The early investigators claimed that gypsum increased crop yields for a time, but its continued use failed to maintain those increases, and, as it contained no nitrogen, phosphorus or potassium, it was regarded as a soil stimulant. Recent investigations have shewn that the value of gypsum is probably due to its sulphur content, as many soils have been found to be deficient in this essential plant-food element, which is more important in the case of certain crops than was formerly supposed. As gypsum supplies sulphur in a form available to plants it may play an important part in the fertility of soils which are deficient in this element. It is believed also that gypsum has an indirect action in modifying other soil constituents. Gypsum cannot replace lime as a means of correcting soil acidity, but opinions differ as to whether or not when applied to soils it tends to make them acid. Gypsum is a neutral salt and on dissociation ought to give rise to hydrogen and hydroxyl-ions of equal concentration, which might modify soil acidity; at the same time there may be secondary reactions, which theoretically may cause a certain amount of acidity.

The author decided to test as far as possible the effect of gypsum on soil reactions.

The literature on the subject contains references to experiments dealing with gypsum itself, and also with superphosphate which contains about 60 % of gypsum, consequently the effect of the fertiliser may be partly due to this substance. The work of GARDNER and BROWN in 1910 on plots which had received gypsum at the rate of 320 lb per acre every two years for a period of 30 years, showed that these plots were slightly more acid than those which had received none, but the difference was so little that FREAK concluded that gypsum did not add to soil acidity.

SCHOLLENBERGER found that gypsum applied to manure decreased acidity; CONNOR obtained similar results; on the contrary, LIPMAN stated that it did not correct acidity; SKINNER and BEATTIE maintained that it added to acidity; SINGH the same. VEITCH and CONNOR applied superphosphate and found acidity decrease. BROOKS, PLUMMER AMES and SCHOLLENBERGER found no appreciable difference. These experiments were carried out by various methods.

The author used TACKE's method, as slightly modified by STEPHENSON: it consisted of treating the soil with an excess of calcium carbonate and estimating the volume of carbon dioxide evolved.

The results were checked by the method of MACINTYRE and WILLIS, based on the determination of the residual carbonate; a direct evaluation was also made of the hydrogen-ion concentration.

To summarise the results, it may be concluded that gypsum applied in amounts up to and including 500 lb. per acre does not increase or decrease the soil-reaction as determined by the TACKE-STEPHENSON meth-

od. An application of 1000 to 2000 lb. per acre causes a slight increase in hydrogen-ions in an acid or neutral soil, but very little in the case of a basic soil.

Gypsum added at the rate of 500 lb. per acre to a neutral soil made to vary in degrees of acidity by additions of HCl and Ca CO<sub>3</sub> had no effect on the hydrogen ion concentration of the soil, and did not show sufficient lime requirement by the STEPHENSON-TACKE method to justify the conclusion that gypsum had any effect on soil acidity. L. V.

808 - **Herbaceous Growth of Arborescent Plants for the Production of Manure and Forage in Cuba.** — CALVINO, M., in *Boletín N. 47, Secretaría de Agricultura, Comercio y Trabajo, Estación Experimental Agronómica*, 16 pp., fig. 6. Habana, 1922

By sowing very thickly the "gelso bianco" (*Morus alba*) or still better *M. multicaulis* and cutting it level with the ground several times a year, a sort of meadow is obtained which can be mown with the same apparatus and machines as herbaceous plants (1).

The writer proposes the adoption of this method for the growth of two arborescent leguminous species of tropical regions introduced into Cuba:— *Cassia siamea* Lamk. (*C. florida* Vahl) and *Albizia Lebbeck* Benth. The former called "Cassia del Siam" in Cuba, "Kassod tree" in the Hawaii islands and "wa" in India, is a native of Southern India, Burma, Ceylon and of the Malay peninsula and Siam. Grown in its natural form it furnishes a good firewood and cabinet wood, grown as a hedge it serves as a wind screen, if sown thickly and cut often it gives a large quantity of herbaceous material rich in nitrogen and suitable for use as green manure.

In the experiments made by the writer at the Havana Experimental Station with seed obtained from the Philippines, by sowing on the 7th May 1920, transplanting at a spacing of 60 cm. × 60 cm. on the 2nd June of the same year and cutting for the first time on the 8th July 1921, the second on the 17th November 1921 and the third on the 31st March 1922, he obtained respectively, without any irrigation, 1212 — 572 — 320 qx. per hectare of tender leafy branches, easily decomposed, each 1000 kilogrammes made up of 498 kg. of leaves and 502 kg. of branches.

The leafy branches at the time of cutting contain in their leaves 52.4 % of moisture, 44.33 % of organic matter and 3.27 % of mineral matter and in the branches respectively 49.85 — 48.64 — 1.51 %. They contain nitrogen in the proportion of 1.88 % in the leaves and 1.3 % in the branches. By drying at 30°, the moisture is reduced to 9.7 % in the leaves and to 7 % in the stems; the nitrogen becomes respectively 3.57 % and 2.40 %. The ash of the leaves contains:— 27.05 % of lime, 12.8 % of potash, 6.12 % of phosphoric acid; the ash of the branches contains respectively 8.78 — 10.63 — 5.05 %. For the purpose of comparison, the writer recalls that the "cowpea" (*Vigna Catjang*) contains in the fresh leaves 0.33 % of nitrogen, the "velvet bean" (*Styrolobium* spp.)

(1) See: R. FORLANI, *Il prato gelso*. Catane, Battiato, 1920. (Ed.)



0.37 % and the "fandul" (*Cajanus indicus*) 1.12 %, that is to say they are all inferior to *Cassia siamea*.

As 1000 parts by weight of fresh leafy branches contain 15.88 of nitrogen, 2.89 of potash, 1.134 of phosphoric acid and 5.03 of lime, if 50 tons of these branches are applied to 1 hectare of land, as green manure, it is furnished with 794 kg of nitrogen + 114.5 kg. of potash + 67 kg. of lime. *Cassia siamea* is not eaten by animals; it is not subject to diseases, nor attacked by insect pests.

For use as transported green manure the writer recommends as follows:— before spreading and burying the cut branches, let them steep in water in which farmyard manure in fermentation has been soaked (as is done in India) and to which has also been added 2 % of phosphate of ammonia or 1 % of superphosphate and 1 % of sulphate of ammonia; much more rapid decomposition is thus obtained. One of the systems suggested in England for the production of artificial manure (1) may also be adopted, that is to say mixing the plant with ground limestone and sulphate of ammonia or simply with cyanamide of calcium and let it ferment by watering from time to time. The writer recommends mixing 100-160 kg. of cyanamide of calcium and an equal quantity of Cuban bats phospho-guano with 2000 kg. of leafy branches.

*Albizia Lebbek*, called "algarrobo de olor" in Cuba, "blackwood" in French Colonies and "women's tong tree" in British Antilles, may be used with the same object. This plant is a native of tropical Asia where it is much used as shade trees for coffee. Compared with *Cassia*, *Albizia* has one disadvantage, it drops its leaves in the middle of the dry season, in spring; but if it is sown very thickly and cut very low it remains always in leaf. It is moreover well liked by cattle and can therefore also be used as forage; its leaves contain 1.19 % of nitrogen and are rich in mineral constituents. As is the case with the "Cassia del Siim", it shoots again rapidly after cutting and grows quickly. Previously the writer had recommended, as a plant for green manure in Mexico, the herbaceous growth of "mezquite" (*Prosopis juliflora*) which is spontaneous in the barren and semi-sterile soils of the "Mesa central".

809 - **Sweet Clover as a Green Manure.** — WHITTING, A. L., and RICHMOND, T. E. in *University of Illinois Agricultural Experiment Station, Bulletin No 233*, pp 255-267. Urbana, May 1921.

Sweet clover (*Melilotus alba*) should prove a promising source for supplying nitrogen to the chief farm crops. Certain characteristics give it a marked superiority over other crops as a green manure. The most important of these are:

Adaptability to a wide range of climatic and soil conditions, if the soil is not acid and inoculation is assured; hardness to cold and drought, resistance to disease and damage from weeds; vigorous growth; rapid decomposition whilst green; deep-rooting habit which renders impervious sub-soils more porous and of higher nutritive value.

(1) See *R. March* 1922, Nos. 236 and 237. (Fd)

A crop that possesses the combined capacity to grow rapidly in early spring and to decompose readily, makes an ideal green manure. Owing to its rapid growth clover conserves large amounts of soluble plant food, utilisable when the soil would otherwise suffer heavy losses. Similar to other legumes, when properly inoculated, the plant can utilise atmospheric nitrogen which it stores in its roots as reserve food material. The leaves are very tender and decay immediately after the crop is turned under green. The roots and stems decay more slowly; thus the different parts represent three sources of nitrogen which furnish three rates of nitrate production.

Hitherto considered as a weed, the sweet clover is now coming to be regarded as the best crop for soil improvement. As it will supply nitrogen at a low cost, it could be employed on a large scale.

The literature concerning sweet clover as a green manure and as a source of nitrogen is very limited. Having been classed for some time as a weed, it has received very little attention by investigators. ORTH in 1890 was the first to test the value of this crop as a green manure and proved its superiority over farmyard manure for the production of potatoes, oats and maize. G. B. HOPKINS recognised the possibilities of this plant as a green manure and in his book on "Soil Fertility and Permanent Agriculture", he states that 6 ½ tons of dry matter furnish as much humus and nitrogen as would be furnished by 25 tons of average farmyard manure. The appreciation of the importance of this crop is evident in that he introduced it into the rotations on several experiment stations and also selected sweet clover as the crop upon which to base his foundation work for restoration of the soils of Greece. In 1917, MAYNARD studied the decomposition for nitrate formation under glass and found it to be very rapid. He mentions that no record has been found of any study of the rate of decay of sweet clover as a green manure.

The work of MERTZ deserves attention, especially designed to compare the value of various green manures, leguminous and non-leguminous, the latter being reinforced with artificial nitrogenous fertilisers. The experiment was conducted in South California. The crops grown for green manures in the winter were followed by maize, potatoes, cabbage, beets, sorghum and Sudan hay, for six successive years. The legumes proved much superior to the non-legumes and amongst the former the bitter clover (*Melilotus indica*) an annual variety of sweet clover was the most promising, both from the standpoint of vigour, of seed supplies and as a green manure. The use of *M. indica* resulted in a gain of nearly 20 bus of shelled maize per acre. This compares favourably with results obtained with an annual application of sodium nitrate giving 1080 lb. per acre of maize and of dried blood giving 1200 lb., taking into account also the cost of these fertilisers.

The advantage of utilising the crop as a manure has been proved by the authors in their experiments made (1918-19) on 5 specially selected fields in northern, central and southern Illinois, in connection with the University Farm, Urbana. A series of plots was arranged as follows:

sweet clover; green manure; control; to the sweet clover and manured plots, rock phosphate or bone meal was added once in four years. On the sweet clover green manure plots, residues were added to compensate for corn stubble. A distinction should be drawn between available and non-available nitrogen as it is most important to keep as much nitrogen as possible in the available form. This is exactly what happens in the case of leguminous crops, which help to contribute large quantities of available nitrogen. The results obtained by the authors indicate that after digging in, the sweet clover tends to increase the proportion of nitrates in the soil, even more than heavy applications of manure. In poor soils the effect is even more marked. The maximum nitrate production was noticed in August which suggests the advisability of ploughing under at an earlier date, and so avoiding any detrimental effect (due to decomposition) on the germinating maize. Another suggestion is the utilisation of the surplus nitrate by sowing a catch crop. When maize is the main crop, the value of the additional nitrate remains although quickly utilised by the crop. Even when manure, lime and phosphate have been used in large quantities (5 times normal application), the yields were not equal to those obtained after sweet clover.

The average for the 2nd year sweet clover crop was 87.6 lb nitrogen per ton of dry matter, the cutting was made before sowing the maize. The subsequent advantage was evident.

These results furnish positive information concerning the value of sweet clover when used as a green manure, for adding to, conserving and making available for crop purposes the nitrogen of the soil. It is well-known that, except for manure, the animal sources of nitrogen (dried blood, tanning residue, guano etc.) are scarce and costly and therefore unsuitable for use on a large scale. This applies also to the use of nitrogenous fertilisers (sodium nitrate, sulphate of ammonia, ammonium phosphate and calcium cyanamide). On the other hand, the leguminous crops offer an exceptional advantage, and sweet clover in particular may in the future occupy a prominent position as a green manure. L. V.

810 - **The Nitrogenous Compounds in Lucerne Hay.** - MILLER, H. C. (Chemical Division of the Oregon Experiment Station), in *The Journal of the American Chemical Society*, Vol. 43, No. 12, pp. 2656-2663. Easton, Pa., December 1921.

The author has succeeded in isolating from lucerne hay certain non-protein nitrogenous compounds containing 40.7% of nitrogen; most of them can be easily extracted with water. Purins make up 3.2% of the total nitrogen. The author has determined the percentages of the different constituents of the protein compounds, and in particular of the amino-acids: arginin, hystidin, lysin, cystin, etc. He finds that they contain 13% of nitrogen, whereas the amount of this substance present in the proteins of lucerne seed is as much as 15.6%, owing to the different percentages of the various constituents, and especially, to the larger quantity of arginin which is very rich in nitrogen. The author describes a new method for the further study of the non-protein substances. This consists

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in the precipitation of the aqueous solution by chloride of mercury and the subsequent removal of the mercury. L. V.

811 - **The Chemical Composition of Plants as a Basis for the Estimation of their Water Requirements.** - NOYES, H. A. (Mellon Institute of Industrial Research, Pittsburg, Pennsylvania), in *The Journal of Industrial and Engineering Chemistry*, Vol. XV, No. 3, pp. 227-228. Washington, March 1, 1922.

The author refers to the results of field and greenhouse experiments carried out at the Agricultural Station of Purdue, La Fayette U. S., which prove that the direct, or indirect, manuring of the soil causes a decrease in the water requirements of growing plants and also changes their composition. Working the land has the same effect, for the soil is thereby more exposed to the air which increases the bacterial activity and this, in its turn, brings about the greater concentration of the soil solution.

By the application of a suitable fertiliser and the timely working of the land all danger from drought could be greatly reduced in the case of crops growing in the wet zones of the United States, for by these means the plants are enabled to enter upon the dry season with an accumulated store of moisture. The manuring of the soil will therefore have to be studied from another point of view viz., the water requirements of the crop.

The author is of opinion that the old advice given to farmers, "work the soil well so as to retain its moisture and the best crops will be obtained", might be modified as follows: cultivate the land thoroughly so that the soil may be well ventilated, because air increases bacterial activity and enables the plants to obtain a larger amount of nutritive substances and to grow with less moisture.

The following data confirm this statement. In the course of his field and orchard experiments made at the Agricultural Experiment Station of Nebraska, KRISSELBACH obtained the results given in the appended Table.

	Cleaned land cover crops	Land dressed with straw	Land untilled for several years
Increased girth of trees from 1911-1916 in cm.	25.5	25.9	17.1
Nitric nitrogen in the soil during the vegetative season per thousand parts of dry soil	57.5	47.0	14.5
Water at beginning of vegetative season, kg. in 30.5 cm. x 30.5 cm. x 22.9 cm	5.12	5.24	5.37
Water at end of vegetative season <i>idem</i>	3.83	5.10	3.66

Greenhouse experiments on *Capsicum annuum* var. *abbreviatum* and lettuce have shown that by the application of dung and of a complete chemical fertiliser the water units required to produce one unit of green

substance are reduced by more than a half, while the plants themselves are 4 times as heavy as the controls. Further, the water requirements estimated by the water content of plants treated in different ways (controls, limed, manured with phosphatic, and nitrogenous fertilisers dung, or complete fertiliser), as well as their nitrogen content (green portions and roots), and the amount of phosphorus and calcium present in their ash all show the existence of a correlation between the composition of plants and their need of water

G A B

**812 - Influence of Conditions of Humidity on the Growth of Sainfoin Seeds respectively Unhusked and Husked.** RIVIERA, V. (R. Stazione di Patologia vegetale Rom 1)

in *Rivista di Biologia* Vol 1 No 1 pp 11 Rome 1922

In the working of meadows of sainfoin (*Onobrychis sativa* All.) the results obtained are very variable, which has led the writer to study closely the growth of the seed of this leguminous plant under the experimental conditions of the laboratory.

For each experiment a portion of the seeds were husked and the others left in their pods. In a first series the seeds were placed in various conditions of humidity by forming 4 groups in Petri capsules: (1) capsules containing water in which the seeds were kept immersed by means of a glass; (2) capsules containing blotting paper abundantly soaked in water; (3) capsules containing blotting paper soaked to a limited extent; (4) capsules in which a humid atmosphere was produced by moistened blotting paper placed inside the cover. The first two groups of seeds behaved in an identical manner: they are therefore considered together, in them the absorption of moisture was very rapid: after 42 hours the maximum was reached and then weight was almost doubled; on the other hand it required 90 hours for the seeds placed on the paper slightly moistened to absorb about half their weight of water and those placed in a humid atmosphere absorbed about one third.

It is interesting to note that the seeds on slightly moistened blotting paper germinated first: it is clear that in the other cases the seeds found themselves in conditions less suitable for their growth owing to excess or deficiency of moisture: the delay has a distinct biological significance but it is evident that excessive conditions of moisture cannot be prolonged beyond a certain limit.

Regarding the different behaviour of unhusked and husked seeds, one of the effects of the presence of the pod is a delay of a few days in the beginning of germination; this delay may be caused by the fact that the soaking of the seed is retarded since the pod first imbibes the water and the seed afterwards; it may also be attributed to the pressure which the pod exerts on the swollen seed.

The amount of water absorbed by the pod is maintained in the same proportion as that absorbed by the seed: in fact the difference between the percentages of water absorbed by the unhusked and husked seeds are negligible, especially after 90 hours. The pod therefore stores much moisture and can restore it later, by its structure, which makes it like a

sponge, it creates an ideal humid chamber for the seeds which it contains. The power of disposal of moisture is therefore, superior in the unhusked seeds than in the naked seeds.

If the seeds are next placed in a dry medium, those which are unhusked lose less moisture than the naked seeds. The writer assured himself of this in a second series of experiments in which he exposed seeds swollen with moisture, to a drying action, obtained by means of chloride of lime. For example, in one of his experiments, after two days drying the unhusked seeds still contained 0.32 gm. of moisture and the naked seeds only 0.19 gm. If the environment becomes suddenly dry, the pod protects the seed from excessive siccation.

When the radicle has developed, it suffers less from dryness in unhusked seeds than in the husked seeds : thus in two lots of 27 seeds each, 10 and 21 radicles respectively were injured. With a return of humidity, even seeds which had their radicles destroyed could protect themselves by sending out fresh lateral roots.

From the above it follows that the pod performs complex functions : it not only favours a wide distribution of the seeds owing to its conformation (wings, prickles, hairs, etc., which, however, vary much in different species of *Onobrychis* and also in varieties), but also forms a mechanical protection to the seed which it covers, and stores moisture which helps the growth of the seed ; the seed enveloped in its pod absorbs moisture and swells more slowly, but more surely.

The pod equalises the variations of humidity in the environment ; sudden differences are borne by the pod, while the seed only feels their mitigated effect. The moisture which is collected through the pod and passes into the seed, serves the latter specially when it grows under dry conditions in the soil.

This behaviour throws light on some vicissitudes in the growth of peas, especially in southern, dry regions, where, it often happens that the seedling, especially if sown in spring and in ground which dries up easily, can only benefit by a single fall of rain, some times even a very slight fall, and that followed by a prolonged drought. The difficult period for plants of this kind is almost always the beginning of the development of the seed, because when in full growth the plant no longer suffers from the dryness of the soil. Now it is precisely at the critical period of need of moisture, however slight, that the function of the pod is useful, for it stores up a greater amount of moisture than the husked grain could absorb and gives it up to the seed later. Furthermore it prevents, in the period which precedes germination and at the beginning of the period which follows it, a sudden and rapid loss of moisture by the seed, when the conditions of environment become suddenly and markedly dry ; lastly it is sometimes useful in retarding germination until the conditions of humidity improve, while the husked seeds which have already germinated perish.

Such are the reasons why, while meadows sown with husked seeds do not succeed, especially if the dry season hinders the first development of the seed, the chance of the meadows is more certain when the seed has

not been husked : this the writer has been able to prove in a series of experiments in the open field, and therefore concludes that it is not advisable to husk the seed.

L. V.

813 - **Absorption of Ions of Aluminium through the Root System of Plants.** — STOKLASA, J. in collaboration with SEBOR, J., TYMICH, P. and GWACHA, F. (Biochemische Abteilung der Staatl. Versuchstation an der böhmischen technischen Hochschule, Prag) in *Biochemische Zeitschrift*, Vol. 128, Nos. 1-3, pp. 35-47. Berlin, March 7, 1922.

The absorption of aluminium was studied for the first time by the Russian physiologist W. ROTHERT, in collaboration with BOROWIKOW and SCHIMKINE: all the plants tested absorbed the element, which was furnished in the form of soluble compounds and even certain insoluble compounds. These researches were followed by those of the writer, of BERTRAND, AGULHON and SZÜCZ.

At present the author has undertaken the analytical study of the problem, using aqueous solutions: he employed a mineral solution of definite composition in which he plunged the roots of young robust plants after careful washing. The aluminium was added in the form of sulphate and control cultures were not neglected. The writer has experimented with two hygrophytes, two mesophytes and two xerophytes.

In a preliminary experiment the sulphate of aluminium was used at a strength of 0.001 gm-atom of aluminium per litre of solution. The xerophytes and several of the mesophytes developed badly. For the analyses, made after 26 days, the writer chose the most healthy samples. All the plants absorbed much aluminium, especially the hygrophytes; the mesophytes absorbed less and the xerophytes still less. The greatest amount of aluminium was found in the roots.

By increasing the concentration of sulphate of aluminium 15 times (0.015 of the atomic weight of aluminium expressed in grammes, per litre of solution), all the plants died: first of all the xerophytes in 7-11 days; then the mesophytes beginning from the 17th day; lastly the hygrophytes as from the 23rd day. The proportion of aluminium absorbed was much less in this than in the previous experiment: aluminium is absorbed to the greatest extent when the solutions are weaker: it is therefore clear that it is not a simple diffusion which takes place, but that a *specific* permeability of the rhizicome is produced, associated with phenomena of absorption and reactions which develop in the intracellular colloids. The aluminium which has penetrated into the cells causes contraction of the protoplast; then, if in strong concentration, it softens and dissolves it (STOKLASA, BERTRAND, AGULHON, SZÜCZ). In the xerophytes, this plasmolysis is more rapidly accomplished; more slowly in the mesophytes and only with strong concentrations in the hygrophytes. The degree of reversibility of the process is conditional on the concentration of the ions of aluminium and on the duration of their action.

Hydrolysable compounds of iron, manganese, copper etc., show themselves still more toxic than those of aluminium; compounds of aluminium can even reduce their poisonous effect, because they take the place

of others in the cells, which causes an exchange and a new balance of cations.

The writer had previously noted this protective action of aluminium but he has now made a more complete study. He selected, with this object, the three species of plants, which in his previous experiments had absorbed the largest amounts of aluminium and he put them to grow in four mineral liquids of identical composition, but one of which being without aluminium or iron, served as control; another contained aluminium; a third contained iron; a fourth both these elements. In the second and third of these nutrient liquids, the absorption of aluminium and of iron were accompanied by an abundant elimination of magnesium, calcium and sodium; that elimination was however, much more marked in the liquid containing iron, evidently because iron exercises a more intense toxic action than aluminium and consequently kills and dissolves the protoplasts, setting free almost all the salts. In the liquid which contained iron and aluminium, the latter diminished the penetration of the iron and, consequently reduced the harmful action; it prevented plasmolysis and limited the loss of mineral principles. The analysis of the plants grown in the four liquids showed that the addition of iron alone sensibly reduced the total ash content while the addition of aluminium and of aluminium and iron increased it, while reducing the content of potassium, sodium and phosphorus.

The three plants studied are plants of peat bogs: they therefore grow well in relatively acid media and are not tolerant of bases. The author has remarked that very many cryptogams behave similarly. He gives the analyses of some of these plants: — ferns, lycopods, horsetails, etc.; their ash is rich in silica, aluminium, iron and sometimes in lime; it is probable that they have adapted themselves to this kind of mineral exchange from the remotest time; it suffices to consider that most coals were formed by these hygrophytes, which utilise the most common mineral elements in the soil:— silica, iron and also sulphur (ferrous and ferric sulphates); it is probable that aluminium had already the power to neutralise the injurious action of iron present in the ground in the form of oxides and hydrates and especially of ferrous and ferric sulphates: it thus limited the absorption of potassium and phosphorus in which, as a matter of fact, coals are poor.

L. V.

814 - **Experiments on the Use of Artificial Light in the Growth of Plants, in Germany.** — HÖSTERMANN, in *Verein Deutscher Ingenieure*, Vol. XVI, No. 21, pp. 523. Berlin, May 27, 1922.

The first experiments on the use of electric light for inducing the growth of plants were made in 1880 by Wilhelm SIEMENS, with a 1600 candle-power arc lamp; these experiments were next reproduced at Bromberg by means of arc lamps and mercury lamps with unsatisfactory results; on the other hand experiments made in England and Ireland in 1919 by TJEHRES and UTHOFF induced an increased yield up to 50 %. In the buildings of the Experimental Station of plant physiology at Dahlem (Germany),



experiments were made during the winter of 1921-22, to ascertain the influence of artificial light on the growth of plants in glass frames ; in winter, in a heated place, the difference of growth of plants, compared with the summer, is determined not only by the temperature and by the manuring which may be the same at both seasons, but also by the duration of day light ; in fact, it is the light absorbed by the chlorophyll which furnishes the energy required for the reduction of carbonic acid into carbon, from which carbohydrates are produced through assimilation. But it is not only daylight which exercises a beneficial action on the process of assimilation ; this action can also be exercised by light coming from another source, provided that it is comprised in the category of wave lengths in the compass of which the colouring matters of the leaves have a power of absorption. The question is to select the light which will give the best return.

According to what can be deduced from researches on the physiology of plants, with a luminous intensity of about 1000 Lux, the assimilation may be considered as proportional to the illumination, while with a more intense light, assimilation is less and less accelerated and thus is why artificial light was not used simultaneously with the winter light, but the day's light was prolonged from dusk by means of an electric current

Over a plot 5 m long by 1.50 m broad were arranged 5 "Nitra" lamps of 200 watts, in such a way that the light could be diffused as uniformly as possible ; the lamps were placed 0.70 m from the edge of the plot, at a distance of 1.20 m from each other at a height of 0.60 m above the plot, and were furnished with WISKOTT reflectors. The intensity of the illumination of the plants varied over different points of the surface of the plot from 300 to 900 Lux, and was exactly 900 Lux under the lamp and 300 at the edge of the plot. The daily consumption of electric power by the lamps, lighted for about 6 hours every day commencing at dusk, amounted to 4.8 kilowatt-hours for lighting a surface of 7 sq. m. Forced cultures were made on that surface, the preceding period of vegetation of some of them had already made it possible to have an idea of the principles assimilated ; others, having just germinated had still to construct their vital elements. Close to the plot of illuminated plants was the control plot, with the same plants and separated from the former by a partition of white wood ; this plot, except for light, received the same care as that of the illuminated plants.

Cabbage-lettuces, illuminated from mid-November, had after 12 days on an average about two and a half times as many fresh leaves as those not illuminated ; moreover, the leaves of the former were larger and firmer, so that after 18 days the plants had developed like lettuces sold at 2 marks each. Plants exposed only to daylight required from 4 to 5 weeks, or double the time to attain this degree of development ; it would therefore be possible, in practice, to obtain in the same period of time two crops of lettuce instead of one. In 18 days the consumption per lamp was 21.6 kilowatt-hours ; the price at the time of the experiment being 1.20 mark per kilowatt-hour, it cost 26 marks for illuminating a surface of 1.2 sq. m. But as (with a doubled crop) 480 marks instead of 240 is drawn from a

surface of 1.2 sq. m., there remains, at this price of electric current, a surplus gain of 214 marks per 1.2 sq. m.

To examine its subsequent growth, the lettuce was left in its place, since it did not flower but continued only to grow. However this very probably, should not be attributed to lack of power of the electric light relatively to solar light, but more especially to the richness of the artificial light in red rays, compared with daylight. The crop was gathered after 7 weeks of prolonged illumination; a comparison was then made between the plants of the illuminated plot and those of the plot not illuminated: a superiority of weight of the former over the latter of 50 % in the green state and 68 % in the dried was found.

The effect was equally good on beans and vetches. *Lathyrus odoratus* grew much more vigorously under the influence of the illumination, and it flowered earlier and more abundantly. Strawberry plants illuminated yielded, as early as the middle of March, very sweet and scented fruit, while those not illuminated were 4 weeks later. The favourable effect of electric light in the prolongation of the short daylight from November to May, was very clearly shown on all greenhouse crops and especially on lilac which gave very fine inflorescences under this treatment, with more intense perfume and brighter colour. But certain data are lacking regarding — 1) the most correct and suitable illumination for certain species of plants, 2) the duration of illumination, 3) the most favourable colours of the light, hence without exact knowledge of the sources of light and of the physiological effects of the light, it is not yet possible to form a correct judgement. P.

815 - Influence of X-rays on dry Seeds and germinating Seeds. - PI TRY, I (Zentral-Institut des Landeskrankenhauses Graz) in *Biochemische Zeitschrift*, Vol 128, Nos. 1-6, pp 326-353. Berlin March 25, 1922.

G. SCHWARTZ has already stated that dry seeds stand, without damage, an intense application of X rays up to 40 times as strong as those to which germinating seeds show themselves sensible. The writer has noted also that, even when respiration is lessened, for example by means of cyanic compounds, sensibility to X rays continues. He has now observed that a rapid hydration of dry seeds or of dried germinating seeds was sufficient to stop or renew this sensibility, which is therefore due to the water and, in this respect, may be compared with the sensibility to heat ferments and proteins. But the water acts not only as such; it causes also the chemical changes inherent to germination. In fact, if the supply of oxygen is suppressed, and germination is thus hindered, sensibility to X rays decreases; on the other hand, germinating seeds which have been dried are always much more sensitive to X rays than dry seeds. Chemical changes therefore intervene which modify the environment; they may consist in the stimulation of the proferments, in hydrolytic splitting up of reserve materials, in oxidising processes, in processes of assimilation and breaking-down. Notable differences are remarked with different seeds; for example, seeds of leguminous plants are much more sensitive to X rays than the seeds of cereals. L. V.

816 - **The Applicability to the Problems of Plant Genetics of Morgan's Theory of the Mechanism of the Chromosomes.** — JONES, D. F., in *The American Naturalist*, Vol. LVI, No. 645, pp. 166-173. Lancaster, P. A., April 1922.

The data so far collected are sufficient to justify the supposition that the chromosome theory postulated in the case of *Drosophila* is equally applicable to plants. The pea, primrose and maize have all furnished excellent material for studying the linkage of genetic factors in the plant world. Owing to the ease with which maize can be cultivated the large number of grains it produces, and its great variability from the genetic standpoint, this plant has been the special object of investigation.

Owing chiefly to the work of EMERSON and his school it has been possible to distinguish in maize 6 groups of linked factors, and in the case of most of these factors their relative position in the chromosome has been determined. Therefore from the study of the genetic phenomena in this plant an indirect proof of the mechanism of the chromosomes has been obtained.

If two families are taken that have been long enough self-fertilised to have become almost, if not quite, homozygous, on crossing an absolutely uniform  $F_1$  is obtained. This is then repeated with two further families and another  $F_1$  is produced. When this point has been reached, the work is carried on in two directions: 1) the two  $F_1$  generations are crossed together and produce  $F_1 \times F_1$ , a double hybrid of the 2nd generation; 2) an  $F_2$  is obtained by the self-fertilisation of the  $F_1$ . Each line of maize so far produced by self-fertilisation has hitherto always been found to differ in many of its characters from any other line no matter whether it is descended from the same variety or from a different original variety. The self-fertilised lines when crossed show a remarkable increase in growth and, if again selfed, a rapid decrease in vigour, together with greatly increased variability in the following generations.

It may therefore be assumed that the greater number of self-fertilised lines differ from one another as regards many of the genes in each chromosome. If this be the case, the double combination  $F_1 \times F_1$  should have a much more complex structure than the  $F_2$ , and a critical comparison of these double hybrids with the hybrid parents of the first generation and with their  $F_2$  by self-fertilisation, if based on the variability of their different characters, ought to afford some indication of the distribution within the chromosome of the genetic factors influencing growth. As regards the other factors, the variability of the double hybrid should be almost the same as that of the 2nd generation obtained by self-fertilisation, though in the characters which are in direct connection with the vigour of the plant, the double hybrid ought to resemble the  $F_1$ , which has lower variability coefficients. To decide these questions, the following characters were investigated: number of rows of grain per cob; the nodes of the plant; the height of the plant; length of the cob; grain production, the weight of the whole female fructification with its ripe grains.

The preliminary study of the 1st generation resulting from the cross of two self-fertilised lines of maize showed that the number of rows of

grain in the hybrid was 5.29 % larger than in either of the parents. As regards the other characters, the percentage increase observed was as follows :

Number of nodes per plant	6 43
Height of plant . .	27.44
Length of cob . .	28 57
Total grain yield . .	180 00

The vigour of the plant therefore has much less effect upon the number of rows and of nodes than upon other characters, especially grain production. Assuming the vigour of the hybrids to be due to the complementary action of the dominant factors, the combination  $F_1 \times F_1$  (the double hybrid), if the factors essential to growth are numerous and distributed uniformly through the chromosomes, ought to be *less variable* than the  $F_2$  obtained by self-fertilisation. On the other hand, characters that are entirely or almost independent of growth vigour (number of rows of grain and number of nodes), should present almost the same variability as the  $F_1$ .

The data given in the annexed Table confirm this hypothesis. The variability of the families  $F_1 \times F_1$  as regards the number of rows and nodes is almost identical with that found for the  $F_2$  families. On the other hand, in all that concerns the characters in correlation with the vigour of the plant, the families of the  $F_1 \times F_1$  show a decreased variability. Further, the fact that all the plants are uniformly vigorous and that their high averages are not to be attributed to the presence of some individuals of exceptional development, proves indirectly that the hereditary factors which control the growth of the plants are very numerous and distributed widely through all the chromosomes, or at least a large number of them.

From the point of view of improving maize, it certainly would be most desirable that all the factors which control the superiority of a hybrid over its parents should be present in a homozygous condition in a single individual. The latter would be in a more stable condition than an individual possessing heterozygous combinations of the factors in question, given that the factors determining growth vigour rarely attain to complete dominance. The recombination of the linked factors is a problem deserving the most careful attention of those interested in genetics. In any case, linked factors are not two paired factors present in the same chromosome but two factors situated in the same chromosome at a distance from one another of less than 50 units. When the distance between the two *loci* is 50 length units (1) or more, factors situated in the same chromosome at a greater distance apart are as independent of one another from the point of view of transmission, as if they were in different chromosomes. The number and arrangement of the genes themselves therefore appear to be of

(1 By 1 2 3 etc., units of length is understood 1-2 3 etc. % of the crossing over. Thus, in the case of two linked characters with a crossing over percentage of 24, it would be said that their genes are situated in two *loci* of the chromosome 24 length units apart (Ed.)

greater importance than the number and arrangement of the chromosomes. When each gene is independent of all the others situated at a distance exceeding 50 units and therefore behaves according to Mendel's law, the author proposes the term of *mendel* for a chromosome segment of a length equivalent to 50 % of the crossing-over.

*Comparative data showing the variability of the 1st generation, of the double 1st generation and of the hybrids of the 2nd generation.*

(CV = Variability coefficient; PE = probable error).

	$F_1$		$F_1 \times F_1$		$F_2$	
	CV	PE	CV	PE	CV	PE
No. of rows of seed	8.90	0.40 - 0.98	12 76	0.52 - 0.65	12 31	0.45 - 0.82
No. of nodes per plant	5.54	0.25 - 0.78	5 88	0.25 - 0.27	6.20	0.26 - 0.33
Height of plant	7.06	0.25 - 1.04	6.20	0.25 - 0.33	6.92	0.26 - 0.40
Length of ear	13 83	0.72 - 1.66	13 23	0.41 - 0.75	16.90	0.69 - 1.03
Weight of seeds	24 13	1.15 - 1.42	26 99	1.19 - 1.44	32 68	1.11 - 2.31

G. A.

817 - Genetic Selection of the Wheats "Bianchetta" and "Gentil rosso", at Andria in Apulia (Italy). - VIVARELLI L., in *La Prova andia 1 raccolto*, 2nd Series, year XIV No 1, pp 115, No. 2, pp 27-31, 2 figs Bari, Jan 1922

Genealogical selection of the wheats "Bianchetta di Puglia" and "Gentil rosso" begun in 1916.

The work was done in three stages. —

1st year: Selection of ears as founders and starting of pure strains.

2nd year: Comparative test of the descendants of these ears.

3rd and following years: Multiplication and propagation of the selected plants.

In the course of these experiments the following characters were specially considered; number of stems; number and length of internodes; average quotient; length of ears; large or small number of leaves, intensity of colour; time of ripening; resistance to lodging and rust, etc.

Among the numerous families thus isolated, the following 4 deserve special attention: — 1) "Bianchetta" fam. A; 2) "Gentil rosso" fam. A.; 3) "Gentil rosso" fam. B.; 4) "Gentil rosso" fam. C. To give an idea of the effect of selection on the morphological and physiological characters the following comparative data relating to unselected "Bianchetta" and "Bianchetta" of the fam. A, are given.

In the average proportion or biometric value of the grain  $\frac{L}{D}$ ,  $L$  represents the length and  $D$  the maximum diameter of the grain, placed groove downward. This proportion indicates that the grain of the selected variety tends sensibly to elongate.

	« Bianchetta » common	« Bianchetta » fam. A
Average height of the plants, in cm. . . .	92	120
Average length of the ears, in cm. . . .	8.5	14.5
Average number of grains per ear . . . .	23	40
Weight of grains of 100 ears, in gm. . . .	101	246
Average proportion, in gm. . . . .	1.90	2.00
Average quotient, in gm. . . . .	0.32	0.20
Aborted spikelets at the base of the rachis.	4	2
Stalks and ears per plant . . . . .	2-3	6-8

In the average quotient or biometric value of the stalk  $\frac{S}{R}$ ,  $S$  represents the thickness of the wall of the stalk in the middle part of the mean internodes and  $R$  the radius of the cavity.

This proportion indicates that the stalk varies in length but that the thickness varies little; there is therefore no reason to fear that the feeding qualities of the straw might decrease by selection, nor that it might become weak and liable to lodge.

The difference in favour of the selected families (see Table below) shows clearly and it has been maintained throughout the three years of the experiment, in spite of great variations in meteorological conditions during the same period.

*Production of grain and straw during the triennial period 1919-1921  
(in quintals per hectare).*

	1919		1920		1921	
	Grain	Straw	Grain	Straw	Grain	Straw
« Bianchetta » common . . . .	7.20	10.70	8.00	12.40	7.50	—
» fam. A. . . . .	9.80	16.30	12.10	19.30	11.50	—
« Gentil rosso » fam. A. . . .	8.50	15.80	10.30	16.20	12.30	—
» » B. . . . .	9.60	17.10	11.80	18.40	—	—
» » C. . . . .	12.30	19.80	12.50	20.10	—	—

G. A.

818 - **Natural Hybrids of Wheat Rye at Saratov (Russia).** - MEISTER, G. K., in *The Journal of Heredity*, Vol. XII, No. 10, pp. 467-470. Washington, December 1921

In 1918, a well authenticated and unusual occurrence was seen at the Agricultural Experiment Station of Saratov (Russia) viz., the existence of a large number of natural hybrids (in the  $F_1$ ) between wheat and rye.

These hybrids made their appearance in some plots sown with winter wheat: *Triticum vulgare* v. *erythrospermum*, v. *Hortianum* and v. *pyro-*

*thrax*. The number varied in the different plots; sometimes they were entirely absent, or very rare; in other plots, they occurred in considerable quantities; plot No. 828 sown with var. *erythrospermum* contained 20 % of the hybrids, while their total number reached several thousand.

The plots containing the largest number of these hybrids were characterised by their early ripening, so that the flowering phase coincided with, or at least overlapped, the flowering phase of the rye. The glumes of these varieties of wheat are very widely open and far apart at the flowering season which facilitates cross-pollination. Owing to the continental, dry climate of Saratov and its low rainfall (about 380 mm.), crosses between different varieties of wheat are of practically habitual occurrence.

In 1917, the year preceding the appearance *en masse* of the wheat  $\times$  rye hybrids, the season had been drier than usual.

The hybrids in question belong to the  $F_1$ , and occupy an intermediate position between *Secale* and *Triticum* with a slight predominance of the characters of *Triticum*. In general habit, the plant is more like wheat than rye, in most of the culms however the upper part of the rachis near the base of the ear is hairy, as is the case in rye.

The seed of the first year ( $F_1$ ) produced 209 plants and these may be divided into 4 groups:

I) Two individuals of the *Secale* type with a tendency to self-pollination

II) 87 individuals of the *Triticum* type. In these, frequent morphological traces of *Secale* were noticeable. buds coloured by anthocyanin — elongated glumes — keel-shaped glumes, etc.

III) 12 plants of entirely new type with long ears and glumes, and a large number of spikelets. In these forms, the rye characters were predominant although the grains were typical wheat grains.

IV) 102 plants of intermediate character.

As regards fertility 29 of the plants were completely sterile, 42 % had only one grain each, 11 % were normally fertile 18 % occupied an intermediate position.

Among the hybrids, new characters, quite different from the characters of either parent, made their appearance as for instance narrow pointed leaves resembling the leaves of certain wild *Gramineae* thick leaves; very brittle rachis; very rough awns culms, with thick walls. In the 3rd and 4th generation, there are typical wheat and typical rye individuals with very few intermediate forms.

When this point was reached it was useless to continue the analysis.

The chief fact to be learnt from the examination of the data collected is that the characters of the hybrids of the first generation, whether the latter are of the typical wheat, or rye, type (or even intermediate), remain fixed in the succeeding generations.

The following question may now be asked. since in the segregation processes there is a clear distinction between the two fundamental forms *Triticum* and *Secale*, what are the characters regulating their resistance to low temperatures? If it be conceded that opposite morphological

characters exist, surely the presence of similarly opposite physiological characters cannot be denied.

As regards the resistance to *Fusarium nivale* evinced by wheat × rye hybrids, distinct segregation has been observed resulting in their division into very resistant and highly susceptible families respectively. This indicates the possibility of obtaining resistant types by means of crossing and selection.

The low temperature resistance of some families of the rye type was found to have diminished, as if they had been forfeited as a result of taking on certain wheat characters.

On the other hand, many of the hybrids of the *Triticum* type showed increased resistance to cold. G. A.

819 — A Study of the Hybrids, Red Rustproof (*Avena sterilis*) × Black Tartarian (*Avena Orientalis*), in the United States. — WAKABAYASHI, S., in *Journal of the American Society of Agronomy*, Vol. 13, Nos. 6-7, pp. 259-266. Washington, October 1921.

This paper gives the results of experiments on the inheritance of resistance to smut (*Ustilago leavis Avenae*), sterility, panicle shape, colour of glume, and correlations among these characters in the  $F_2$  and  $F_3$  of Red Rustproof (*Avena sterilis*) × Black Tartarian (*Avena orientalis*).

TABLE I. — Comparison between the chief characters of the two Parents.

Characters	Red Rust proof	Black Tartarian
Average height, inches . . . . .	32	2.3
Average number of culms per plant . . .	83	2.3
Average number of kernels per panicle . .	45	169
Susceptibility to smut . . . . .	Immune	Susceptible (av. 34%)
Percentage of sterile flowers . . . . .	25	14
Shape of panicle . . . . .	Pyramidal	One-sided
Average length of panicle (in ches) . . .	5	11

The most important results obtained may be summarised as follows :

I. — SMUT RESISTANCE. — Red Rustproof has never shown a single indication of smutting, whereas the percentage of rust infected Black Tartarian plants ranged from 25 to 40. The  $F_1$  and  $F_2$  have never shown a trace of smut. In the  $F_3$ , there were 12 infected lines, while 95 remained immune. In the 12 infected lines, the percentage of diseased plants was 15 — 12 — 9 — 8 — 4 — 4 — 4 — 3 — 3 — 2 — 2 — and 0.1 respectively, thus the most susceptible row produced less than half as much smut as the susceptible parent.

The cause of immunity up to the  $F_2$  and the pronounced resistance in the  $F_3$  indicate the existence of multiple factors. Since the susceptible parent showed smut on less than half the plants, the behaviour of the  $F_3$  is nearly what is to be expected if the immunity of Red Rustproof



is caused by 3 independent dominant factors any one of which would prevent the appearance of *Ustilago*.

The fact that resistance is dominant is unusual, inasmuch as it has been reported recessive in wheat yellow rust (BIRKEN and NILSSON-EHLE) and in stinking smut of wheat (GAINES)

II — STERILITY — The record shows Red Rustproof to be higher in sterility than Black Tartarian. Their crosses are comparatively high in sterility, although this sterility decreases in successive generations because the sterile strains eliminate themselves. Great differences were observed between one panicle and another, some being 100 % sterile, while a few were less than 5 % sterile.

Table II shows the sterility in the parents and the  $F_1$ ,  $F_2$  and  $F_3$ . It proves the progressive decrease of sterility in the successive generations when averaged, but the increased fertility of some of the  $F_3$  rows suggests multiple factors and is of economic importance.

TABLE II — *Comparative Sterility of Red Rustproof and Black Tartarian oats and their Hybrids of the First Three Generations*

Variety		Number of fertile flowers	Number of sterile flowers	Sterility percentage
Red Rustproof		454	112	25
Black Tartarian		1 452	246	14
Red Rustproof	Black Tartarian $F_1$	122	197	62
"	" $F_2$	2 802	3 663	57
"	" $F_3$	39 721	23 935	38
Black Tartarian	$\times$ Red Rustproof $F_1$	68	167	71
"	" $F_2$	1 158	620	35

III — COLOUR OF THE GLUMES — Red Rustproof has white glumes slightly tinted with red (**bb**); Black Tartarian has dark brownish or black glumes (**BB**). It is difficult to distinguish **Bb** from **BB**. If, however, the two classes are combined, the proportion is 72 % of plants with coloured glumes and 28 % with white, which approaches the monohybrid ratio 3 : 1.

IV — SHAPE OF THE PANICLE — The author spent much time in trying to classify the  $F_3$  and  $F_2$  panicle types segregating in 1919, but owing to the rapidity with which the material ripened and the changes produced by different stages of maturity the classification was unsatisfactory. It was, however, sufficiently accurate to show that the inheritance of the asymmetrical or horsenane type of panicle is recessive, but produced by multiple factors.

V. — DWARFNESS. — In most cases, plants which were below 24 inches in height were counted as dwarf. The production of dwarf plants was interfered with by sterility, and it is therefore difficult to state whether it is a simple Mendelian character.

TABLE III. — *Correlation between Colour of Glumes, Shape of Panicle and Height of Plant.*

Black asymmetrical panicle		Black pyramidal panicle		White asymmetrical panicle		White intermediate panicle		White pyramidal panicle	
No of plants	Height in inches	No of plants	Height in inches	No. of plants	Height in inches	No of plants	Height in inches	No of plants	Height in inches
I	15	I	70	I	45	3	50	I	45
I	40	—	—	2	50	—	—	I	67
I	45	—	—	2	55	—	—	—	—
I	60	—	—	I	65	—	—	—	—
I	67	—	—	I	67	—	—	—	—

VI — CORRELATION — Table III classifies the smutted oat plants according to colour of glumes, shape of panicles and height

There seems to be some correlation between dwarfness and sterility, and between smut susceptibility and dwarfness. There may also be a correlation between smut susceptibility and the white colour of the glume, and between susceptibility and asymmetrical panicle.

Sterility is not correlated with the colour of the glume or the shape of the panicle.

G A

820 — **The Improvement of Sorghum by Crossing and Selection in the United States.** — VINHALL, N N, and CRON, A B, in *The Journal of Heredity*, Vol XII, No 10, pp. 435 443 + figs 6 Washington, December 1921

Until recently, all the studies on the hybridisation of sorghum in the United States have been confined to the subject of natural hybrids. Now, however, that the separation and isolation required to obtain pure lines is finished and the pure lines have not proved as satisfactory as was expected, the investigators are persuaded of the necessity of having recourse to crossing, if any further improvements are to be attained.

In the hybridisation experiments carried out by the Office of Forage Crop Investigations in greenhouses in Washington, and in experiment fields at Amarillo (Texas), the following system is adopted.

1st Generation. — The grain obtained by cross fertilisation is sown in rows and the  $F_1$  plants bagged to prevent the access of foreign pollen.

2nd Generation. — The grain produced by the  $F_1$  plants is sown in rows. The best plants of the  $F_2$  are chosen when they are well developed and their inflorescences are isolated in order to carry out comparative tests with their parents and other commercial varieties.

3rd Generation — The grain of chosen individuals from the  $F_2$  is sown in rows, one row being reserved for each plant (Head to row). The best individuals of the  $F_3$  are chosen out and isolated, enough seed being taken if possible to sow a whole experiment plot next year. When the rows are very uniform they are regarded as units.

**4th Generation.** — The best lines of the  $F_3$  are sown in duplicate plots protected from cross-pollination by high rows of maize.

The forage and grain yields are taken as a basis for estimating the quality.

**5th Generation.** — The best rows of the 4th generation are propagated more extensively in order to obtain a supply of seed for comparative experiments on a large scale.

**FETERITA × KAFFIR.** — Contrary to all expectation the plants of the  $F_1$  had panicles with brown seeds whereas the seeds of Kaffir are white slightly spotted with brown, and those of Feterita are bluish white with a slight brown tinge on the glume.

In general appearance the hybrid chiefly resembles the Kaffir parent.

In the  $F_2$ , the segregation phenomena are very complicated owing to the appearance of extreme types ranging from a dwarf form, 60-70 cm. in height, to a tall form over 2 m. high. The plants vary also in the development of the leaves, the shape and density of the panicle, the size and colour of the grain, the succulence and sweetness of the stem and in many other characters.

The types chosen for the subsequent experiments are intermediate between their two parents in most of their characters and resemble in many ways "Dwarf hegari".

Many types selected according to the system described above remained fixed from the third generation.

The following Table gives the comparative data for the type F. C. I. 8921, the parents and two other hybrids: 9917 and 8929.

*Forage and Grain Yield of the varieties Feterita and Kaffir as compared with the Yield of the Three Hybrids Feterita × Kaffir.*

No. of series	Varieties	Forage quintals per hectare		Grain quintals per hectare		Relative forage yield Kaffir = 100	Relative grain yield Kaffir = 100
		1920	1921	1920	1921		
811	Feterita	50.1	29.1	19.7	13.2	97	104
8917	Feterita × Kaffir	26.4	20.1	21.6	18.3	57	127
8921	" "	56.4	30.0	21.3	19.9	105	128
8929	" "	—	34.2	—	18.7	—	—
24983	Kaffir (Dwarf)	52.6	29.7	18.9	12.5	100	100

These figures show the superiority of the hybrid 8921 over its parents, both as regards grain yield and forage production. The object of this work was not only to increase grain crop, but included more strictly genetic aims such as the study of the heredity of grain colour, of the colour and shape of the glumes and of awn development.

**COLOUR OF THE GRAIN.** — *Feterita × Red Amber.* The kernels of Feterita are bluish white with narrow brown zones; in the Red Amber kernels, brownish-red predominates. In the  $F_1$ , the brown-red colour

appears while the segregation phenomena in the  $F_2$  show that there are 2 genetic factors coming into play, R (red) B (brown). Feterita should have the formula  $rr\ bb$ . Red Amber  $RR\ BB$  and the hybrid of the first generation  $Rr\ Bb$ .

*Feterita*  $\times$  *Kaffir* and *Kaffir*  $\times$  *Feterita*; here again there appear to be 2 factors, but they are not the same as those in the preceding case.

*Blackhull Kaffir* seems to have the factor B for brown, while in *Feterita*, a factor S breaks up the uniform brown of *Kaffir* into dots and patches. The formulae thus are as follows: *Feterita*  $SS\ bb$  and *Kaffir*  $ss\ BB$ .

COLOUR OF THE PALAE. — *Red Amber*  $\times$  *Feterita*:  $F_1$  is uniformly red like Red Amber. The brownish-red of Red Amber is dominant as regards the black of *Feterita*. In the  $F_2$ , red and black appear in the ratio 759:241.

AWN DEVELOPMENT. — *Dwarf Milo*  $\times$  *Feterita*. — Milo is awned, *Feterita* is awnless. The 1st generation is awnless; in the 2nd generation there were 183 awnless and 68 awned plants.

Thus the awned character is recessive

SHAPE OF GLUMES. — *Dwarf Milo*  $\times$  *Feterita* — Milo has large, truncated glumes, while the glumes of *Feterita* are slender and pointed. The Milo shape is dominant in fact, in the  $F_1$ , there were 187 plants with blunt glumes and 64 with pointed glumes.

G. A

821 - Correlation between the Colour of the Spermoderm in Peas and the Shape of the Seeds. — PAERLES, J. J. TJBELLS, K., UPHOFER, J. C., in *Genet.*, Vol. IV, part 1, p. 23-31. The Hague, Jan. 1922.

Results of some crosses between Dutch and American varieties of peas.

"Blauwpeul" has large seeds of a brown-yellow colour, flat in shape. The pigment is situated in the spermoderm, it lacks the genetic factor which determines the concentration of the pigment into spots. "Krombeck" is a variety with crooked pods, yellow cotyledons and unpigmented spermoderm; but it has the factor which determines mottling.

By crossing "Blauwpeul" with "Krombeck", hybrids with the spermoderm mottled or spotted with brown were obtained in  $F_1$  "Kroonerwt", a green pea with large round seed also possesses the factor which induces the concentration of the pigment into spots.

From "Blauwpeul"  $\times$  "Kroonerwt", hybrids were obtained in  $F_1$  with flat seed with brown-yellow spermoderm spotted dark violet. "American Wonder", has large, green wrinkled seeds; it lacks the factor for spottedness and, crossing it with "Blauwpeul" plants with flat seeds of plain yellow-brown colour were obtained.

These experiments show the correlation which exists between the presence of pigment and the shape of the seeds; coloured seeds are always flat and wrinkled and round seeds always have a spermoderm lacking in pigment.

G. A.

822 - **Self-Pollination and Cross-Pollination in the Coconut Palm.** — ALDARA, V C., in *The Philippine Agriculturist*, Vol X, No 5, pp 195-207, Plates 2 Los Baños, Laguna, December 1921

The results of the author's researches and experiments have shown that self-pollination and cross-pollination are both possible in the case of the coconut palm

The majority of the male flowers in one cluster begin to open about 6 o'clock in the morning, but the anthers do not dehisce before 8 o'clock. The female flowers in the same cluster become receptive after 2 or 3 weeks from the time of the appearance of the inflorescence

Insects and wind may serve as agents in pollination. Amongst such insects are *Lucilia* sp (Diptera) — *Sarcophaga* sp — *Vespa luctuosa* Sauss., *Rhynchium atrum* Sauss., *Apis indica* Fabr., *Trigona biroi* Fabr. (Hymenoptera) — *Prenocerus caeruleipennis* Peity (Coleoptera)

The positive results obtained by artificial cross-pollination are also very interesting from the standpoint of applied genetics (see following Table)

*Artificial Cross-Pollination in the Coconut Palm*

Set No	Designation of cluster and tree	Date when cluster appeared	Date when male flowers were removed and the cluster bagged	Date when female flowers were pollinated	Polliniser	No of female flowers pollinated	No of nuts formed	Percentage formed
1	C <sub>7</sub> T <sub>1</sub>	Oct 10	Oct 10	Nov 4	C <sub>8</sub> T <sub>1</sub>	10	0	0
2	C <sub>8</sub> T <sub>1</sub>	Nov 4	Nov 22	Nov 24	C <sub>1</sub> T <sub>6</sub>	6	0	0
3	C <sub>3</sub> T <sub>2</sub>	id	Nov 5	Nov 11	C <sub>1</sub> T <sub>6</sub>	4	2	50
4	C <sub>4</sub> T <sub>3</sub>	Oct 10	Oct 20	Nov 4	C <sub>8</sub> T <sub>1</sub>	7	2	28
5	C <sub>5</sub> T <sub>3</sub>	Nov. 3	Nov 19	Nov 27	C <sub>2</sub> T <sub>4</sub>	6	1	16
6	C <sub>1</sub> T <sub>4</sub>	id	Nov 21	id	C <sub>1</sub> T <sub>6</sub>	6	1	16
7	C <sub>1</sub> T <sub>5</sub>	id	Nov 29	Dec 13	C <sub>2</sub> T <sub>6</sub>	4	0	0
						5	3	60
						7	3	43

There are abundant pollen grains in a cluster of flowers. The pollen grains germinate in 5 to 30%, sugar solutions. The pollen remains viable from 2 to 9 days after leaving the anther. G. A.

823 **The Improvement of the Sugar-Cane by Selection, in the Philippines.**

MENDIOLA, N B. in *The Philippine Agriculturist* Vol X No 5 pp 211-215, 12 pl Los Baños, Laguna, December 1921

The sugar-canes at present grown in the Philippines mostly belong to low-yielding varieties that are very subject to disease. The author recognises that it is necessary to practise both crossing and selection in order to obtain better combinations of characters. He also reports on the promising work that has already been begun in this direction.

The process is very simple: the most vigorous and healthy plants in

the field are chosen; the ripe seeds (taken from the finest inflorescences), of one variety are sown separately in wooden boxes or frames, in which the soil should not be less than 10 cm. deep. These germination boxes must be covered with white-washed pieces of glass, or with glass with old jute sacks on the top. If weak or sickly seedlings appear, they are pulled up and burnt immediately. As the plants grow, they are transplanted to larger boxes, in which the soil is not less than 15 cm. deep, or to bamboo tubes cut into the shape of small pots. The boxes and tubes are not to be covered, but protected from direct sunlight. When the depth of the soil in the boxes is no longer sufficient for the proper development of the seedlings, the latter must be transplanted to the field or potted. During the first year of this work about 10 000 seedlings were obtained, but nearly one half died before reaching maturity.

When the sugar-cane plant is mature, it may be divided roughly into three types — the large, medium and slender. In each group there is great variability in colour.

The large canes are more or less similar in size to the Zambales, the Hambledon Seedling 1900, the Hawaiian Seedlings and other imported heavy canes.

The medium seedlings somewhat resemble the native canes in size, and the Japanese or "Uba" in habit and other characteristics. Most of the slender seedlings are in appearance and other characters like the Japanese or the "Uba" canes.

The second year of the test, 200 selected seedlings were sent to different places, in order to study their botanical and agricultural characters and especially their resistance to Fiji disease (observed for the first time in the Fiji Islands), of which the pathogenetic agent is still unknown.

The work of testing and isolating the best individuals and of obtaining new plants from seed is still being carried on. In 1920-1921 a second group of seedlings was raised.

Pedigree No.	No. of seedlings
H-109 . . . . .	3
Badila . . . . .	75
Louisiana Striped . . . . .	4
C.A. 15 482 . . . . .	34
C.A. 13 922 . . . . .	42
C.A. 13 725 . . . . .	25
C.A. 14 861 . . . . .	10
C.A. 13 907 . . . . .	16
C.A. 13 917 . . . . .	6
C.A. (unknown) . . . . .	8

P. A.

824 - The Improvement by Crossing and Selection of the Raspberry (*Rubus idaeus* etc.) and the Blackberry (*Rubus fruticosus* etc.) in the United States. NEES, H. in *The Journal of Heredity*, Vol. XII No. 10 pp. 441-455 figs. 1. Washington December 1921

The author gives an account of the crossing and selection work carried out with *Rubus* at the Texas Agricultural Experiment Station since 1909. Two methods were adopted:

1) Very dissimilar forms were intercrossed in order to be able better to distinguish the elementary characters throughout the complicated processes of segregation and recombination.

2) A large number of seedlings of each variety were cultivated with the object of studying any variations that might occur and using them in the selection work.

COMMON THORNTLESS BRAMBLE - The ordinary Mac Donald bramble indigenous to Texas and which is thought to be a natural hybrid is provided with thorns and has a diffuse habit of growth.

The author cultivated 2000 of these plants from seed amongst them was a group of individuals of which the leaf blades were tough, glossy, smooth and almost coriaceous having three to five lanceolate leaflets with almost entire margins. In this group were found two entirely thornless individuals one spineless and diffuse and the other spineless and erect. Four generations of the former have already been observed and they show considerable fixity and constancy of character. The seedlings of this type can be distinguished as soon as the first leaf unfolds which is cordate or cordate lanceolate with entire or slightly dentate margins and much resembles the leaf of the violet for which it may be easily mistaken.

EARLY HARVEST (*Rubus floridus*) × AUSTIN MAYES (*R. Baileyanus floridus*) - Early Harvest has fruits of small size but they are very sweet and the seeds are very small, Austin Mayes bears large clusters containing several small berries with large seeds, an acid flavour and no ironia.

In the  $F_1$  individuals were obtained in which the characters of Mayes were clearly predominant though the clusters of fruit were very irregular and composed of small berries (Early Harvest) and of small and large berries mixed (Mayes). From one individual of intermediate character there were obtained in the  $I_2$  generation 367 seedlings of the Mayes type 37 intermediate and 21 of the Early Harvest type.

COMMON BRAMBLE × RASPBERRY - The experiments in crossing the common bramble with the raspberry were of special interest and proved successful. *Rubus rubricatus* (Rvdb) was chosen for the mother plant and fertilised with pollen from two kinds of red raspberry Brilliant and London (*Rubus strigosus*). After numberless difficulties due to the sterility of the  $F_1$  hybrids, a good crop of fruit of the  $F_1$  was finally obtained in 1915, and from the seeds a second generation ( $F_2$ ) of 280 individuals were grown, 125 of which reached maturity in 1917. Since, however, the mother plants of the  $F_1$  had not been isolated, the genetic composition of the  $F_2$  is a little uncertain. In any case, the above-mentioned

125 plants can be divided into 28 % in which the raspberry character is dominant, 41 % with the bramble characters; 22 % intermediate; 3 % indefinite

From the group in which the raspberry character was dominant, 5 plants characterised by their regular and high yield were selected

All these plants have the habit of the raspberry, their stems being strong and either erect or procumbent and covered with numerous, short, weak thorns. The leaves are large and similar in structure to those of the raspberry with three, or five, round leaflets, the flowers are intermediate in size between the flowers of the parent plants, and grow in clusters at the end of long peduncles, as in the case of the bramble. The fruit which is dark cherry-red in colour, turns a blackish-brown before ripening, it is larger than the berries of either parent and has a slightly acid flavour with a scent very similar to that of the raspberry.

From a large number of  $F_3$  hybrids, 4 individuals were chosen to propagate this new type of which the fixity and homogeneity had already been proved to the 3rd generation. The 4 selected plants bore fruit from the second half of May to the middle of August, being 3 months old at the date of fructification.

The fruit, even at the end of the season did not lose its aroma or decrease in size.

These experiments proved one notable fact viz., that normal fertility was only manifested by the most robust individuals of the  $F_2$  in which the raspberry character was predominant sterility being apparently a transitory phenomenon.

Not only did the plants of the  $F_2$  and  $F_3$  become perfectly self-fertile, but their pollen possessed extraordinary vitality even when applied to rather distantly related forms.

The  $F_2$  and  $F_3$  also distinguished themselves by resisting the drought and high temperatures of 1918.

Thus the objects of making these crosses between the Bramble and Raspberry have been successfully attained

G A

#### AGRICULTURAL SEEDS

825 — Rapid Determination of the Germinating Power of Seed. — L. J. SAGE P. in *Compte Rendus de l'Académie des Sciences* Vol 171, No 11, pp 762-766 Paris, 13 March 1922.

In connection with a publication of M. M. NEMEL and DUCHON (1) the writer recalls a method which he brought to notice in 1911 and which he has recently completed. This method makes it possible to recognise whether seeds possess germination power without submitting them to germination tests. The writer placed seeds of *Lepidium sativum* in dilute solutions of caustic potash, if these seeds were capable of germinating, they coloured egg-yellow a dilute solution with a maximum concentration of 2.5 N (normal) in 4 hours at most, if on the other hand they had lost their vitality, they coloured also a very dilute solution, with a maximum

(1) See R. March 1922, No 253 (Ed.)



strength of  $\frac{3}{4}$  2-° N. In practice a solution between these two limits would be satisfactory. The coloration would indicate the incapacity to germinate. The author has ascertained that this method can also be used for seeds of 16 other plants experimented on. He considers that it offers a starting point for the physico-chemical study of seeds and that it has a practical value. L. V.

826 - "Trigu biancu", "Trigu arrubiu" and "Trigu moru", Varieties of Wheat grown in the Province of Cagliari, Sardinia (1). - BLANDINI, E. (R. Cattedra Ambulante di Agricoltura di Cagliari), in *L'Italia Agricola*, Year 59, No. 1, p. 16, 1 full page col. pl.; No. 2, p. 48, 1 full page col. pl.; No. 6, p. 179, 1 full page col. pl. Piacenza, 15 Jan., 15 Feb. and 15 June 1922.

CEREALS  
AND  
PULSE CROPS

"TRIGU BIANCU" (White wheat). — A hard wheat with normal vegetative cycle, cultivated mainly for making bread, in the plain of Sanluri. It tillers less than "trigu moru" (1); for this reason 1 quintal per hectare is sown.

It has little resistance to lodging and drought, but it is resistant to rust which, in the marshy lands of Sanluri causes much damage to other varieties of wheat.

Characteristics: — *ear* rectangular, light yellow, bearded, 20-23 loose fertile spikelets; *spikelets* with 2-3 fertile flowers *glumes*; oval lanceolate, with very marked sharp keel, terminated by a long pointed rostrum, and wax coloured edge; *glumules* oval bulging, with awns yellow wax colour; *grain* yellowish white, slightly gibbous, wrinkled, ventral profile slightly concave; *stalk* with semi-solid straw. It resembles very much the varieties called "Saragolletta" in Basilicata and "Farru" in Sicily.

"TRIGU ARRUBIU" (Red wheat). — A hard wheat with normal vegetative cycle, grown exclusively for making bread. Like "murrù" it tillers much but it is less resistant to lodging. It has the drawback of losing its ear at physiological maturity.

Characteristics: — *ear* golden-red, square, bearded, with 25-27 compact fertile spikelets; *spikelets* with 3-4 fertile flowers; *glumes* oval lanceolate, slightly keeled, terminated by a long pointed rostrum, edge red shaded with blue; *glumules* oval bulging, with golden yellow awns, deciduous at maturity; *grain* small 5-7 mm. long by 2 mm. broad; *stalk* hollow in the first three internodes, solid in the others. It resembles very much the varieties called "Rossia" in Basilicata and "Ruscia" in Sicily.

"TRIGU MORU" (Black wheat). — A hard wheat, with normal vegetative cycle, resistant to lodging, but loses its grain at advanced maturity. Owing to this defect it is grown in a zone of small extent (plain of Sanluri and Sulcio).

Characteristics: — *ear* rectangular, black with glaucous reflexion, bearded, with 23-35 compact fertile spikelets; *spikelets* with 3-4 fer-

(1) See R. March 1922, No. 254. (Ed.).

tile flowers, *glumes* oval lanceolate, with very marked sharp keel, terminated by a long pointed rostrum and with a bluish edge; *glumules* oval bulging, terminated by long awns dark black at the base and golden-red at the point, deciduous at maturity, *grain* golden-yellow, very gibbous, ventral profile concave, average length 8 mm, breadth 3 mm, *stalks* with solid straw in the 3 first internodes, semi-solid in the others, *ear* easily detached from the stalk at maturity. It resembles very much the varieties called "Zingarella" in Basilicata and "Scurzunera" in Sicily. F. D.

## STARCH CROPS

827 - Potatoes in the Islands of Chiloé (Chili). CARDINAS ANDRADE, O. in *Revista Universitaria*, Vol. VII, No. 1, p. 27-43. Santiago of Chili May 1922.

In the valleys of the Andes situated in the part of the Cordilleras opposite the island, as well as in the north part of Chili, indigenous growths of potatoes may still be seen at the present time. It is one of the most important crops in the island. Among the Provinces of Chili the crop grown in this island stands first as regards area planted under potatoes and fifth as regards yield per hectare, the average is 111 quintals, but with better tillage and manuring 300 quintals might be obtained.

MANURE - farmyard manure, sea-weed, house sweepings, "jibias" guano, folding of animals. Dung-heaps are not used, the pen where the animals pass the night is covered with the straw of cereals or vetches or with dry grass, every three or four days a fresh layer is added. The sea-weed is spread evenly on the ground to a depth of 10 to 20 cm. as soon as it is collected, or else if the quantity available is not sufficient, it is placed at intervals of 80 to 90 cm. or it is first placed in heaps or "hurones",  $\frac{1}{8}$  of a litre per plant is supplied.

The house sweepings are heaped up and allowed to ferment, sometimes straw is mixed with them, twice as much is used as in the case of farmyard manure. Their efficiency is mostly due to the ashes which they contain. The "jibias" or cuttle-fish are large marine cephalopods of an average weight of 25 kilogrammes and never less than 15 kilogrammes, very plentiful and easily caught from March to August, they are placed in alternate layers with earth between a compost is thus obtained which is spread later, it can also be used in another manner but less advantageously, fleshy portions, 12 to 15 per "jibia", are separated and buried in the between the potato plants, but never in contact with the plant which would be injured by it. Other manures have to be added to the "jibia", as it does not suffice, by itself to give a good crop.

The islands of the Deserterers furnish from 150 to 200 tons a year of "guano piedra caltus" which is composed of sand rich in the droppings of sea birds, it is scarcely used except in these islands, in addition there is a little walrus and bat guano on Talcán island. Regarding folding, a hundred sheep or more are kept for several consecutive nights in a square with 15 metre sides.

SORTING THE SETS - This is done with great care and twice over: in the field and in the house. When the crop is lifted a single heap is

made for each day's work; in the evening each labourer places the best tubers in sacks and carries them to the house, while he selects and places in separate heaps the very large tubers and all those which belong to other varieties; in the original heap only very small tubers, or those malformed or injured by the plough, or which in some way or other are not quite sound remain. After the harvest all the other heaps are also taken to the house, but care is taken to keep the different qualities separate.

The second sorting is more rigorous and takes place during the winter months, by separating the tubers for planting ("semillón") from the larger which are sold, and eliminating all those which are injured or which do not belong to the desired variety and have escaped the first sorting. If the sets have eyes, even small ones, they are removed.

PLANTING. — Two seasons; at the commencement of winter and in spring; the former is only for domestic consumption, for it produces early potatoes, too watery to be stored.

Lines from 80 to 90 cm. apart, and holes made with a peg at distances of 40 cm. are laid out by eye, and nevertheless the work is perfect. On sloping ground planting is done in the direction of the slope, one or two tubers being placed in each hole. About 17 quintals of sets are used per hectare. The manure is applied at the time of planting or on the following day. The spaces between the lines are ploughed, the clods of earth being turned over on to the line; by passing twice in opposite directions along the same space, open ridges are made on the lines. The ends of the lines, which the plough, drawn by oxen, has not properly ploughed are completed with a kind of 2-furrow plough worked by hand, called "lumas".

CULTIVATION. — This consists in breaking up the crust, weeding and keeping the ridges in order, this being done when the plants have sprung up, and in earthing up, which is done when the plants have reached a height of 15 cm. This operation is so important that when it cannot be done the crop is not dug up, it being considered *a priori* too scanty to be worth digging.

For the execution of this latter operation, which is called "quechatum" there is generally an exchange of labour ("mingo") between neighbouring farmers.

A few years ago, about 200 varieties of potatoes were grown in the island of Chiloé; but as the trade only wants the "corahila", this has taken the place of a great many other varieties, of which only some fifty remain at present. According to the writer the "mantequilla" is the best of all, with its fine yellow flesh and its very pleasant taste; but its yield is not very high. The "oro" is very highly thought of by the farmers of the island; for domestic or local consumption, the varieties "alerce", "toldena", "cabra" are grown. By far the most extensively cultivated variety is the "corahila".

The writer gives a list of 110 varieties which, for the most part, exist at present in the island in a wild state. Among these varieties the writer mentions:— the "emperor" of large size, good flavour, very suitable

for early planting, the "camote" whose tubers have a purple flesh, which imparts part of its colouring matter to other foods with which it is cooked, giving them a purple colour; its yield is fairly high; "michuñ", "mechoe", "picun negra" and other varieties show fine purple mottling which disappears in cooking.

If the soils are divided into 4 classes in decreasing order of fertility, the following average yields are obtained :—

1st Class soils	350 to 700	quintals per hectare
2nd " "	170 to 310	" " "
3rd " "	70 to 170	" " "
4th " "	70 to 100	" " "

The large yielding varieties are the following :— "camote" — "corahila" — "chapedes"; those of medium production :— "alerce" — "toltena" — "caballero"; small producers :— "mantequilla" — "michunes" — "cabras" — "rosas"

USES. — All these potatoes are used exclusively for food; they have no industrial use. Their flavour is much improved by placing them on gratings over the hearth, so that the smoke envelops them; slight longitudinal incisions 1 cm. long at intervals of 1 cm. are first made: after 8-10 days they are taken out of the smoke: the name "anquentos" is given to tubers so treated.

"Milcado" is a mixture of grated raw potatoes, cooked potatoes and wheat flour kneaded together; it is cooked in an oven or on a grid, or else boiled or fried and is better than bread.

"Chufño" is starch prepared in the following manner :— by grating, washing, filtration, decantation and drying the starch separated by decantation and finally grinding.

DISEASES AND PESTS. — The only disease which causes damage is "sarna" (*Oospora scabies*) which the local farmers attribute to the tubers being left too long in the ground and which they prevent by not delaying the harvest or by making it early. In this way, in 80 % of the cases, a satisfactory result is obtained. The variety which is most liable to this disease, especially in new moist soils, is the "corahila" to such an extent that in some places its growth has been abandoned.

In certain limited localities, the plants are attacked by insects ("bichos") called "cuncunilla"; they have been controlled, with satisfactory results, by the following mixture :— 16 kg. of bran + 2 kg. of molasses + 1 kg. of Paris green.

The general immunity of Chiloe potatoes with regard to diseases is all the more remarkable as the island has a damp, foggy climate. It must be attributed :— 1) to the congenital robustness of the varieties; 2) to the custom of smoking the tubers for planting by keeping them hung up in frames on the ceiling of the kitchen. This practice is worthy of notice as apparently it is not known outside the island.

F. D.

828 - **Problems of Cotton Cultivation for Discussion at the International Congress at Rio de Janeiro (October 1922).** -- I DE CAMPOS, D., *O Algodão no Brasil e a Conferencia Mundial Algodoeira de Nova Orleans*, pp 1-29 Rome, 1920 -- II *Textile World Journal (World Cotton Conference Number)*, Vol LIV, No 16, pp 139-229 Boston, Nov 22, 1919 -- III *Book of the World Cotton Conference, Liverpool-Manchester June 13-22, 1921* Published by the Executive Committee, Liverpool, 1922 -- IV RICCI, U., *La conférence cotonnière mondiale de Liverpool et Manchester Rapport N. 84* (VIème Assemblée Générale de l'Inst Int d'Agric, 8 Mai 1922), pp 1-53 Rome 1922 -- V *Relatorio de la 1ª Conferencia Algodoeira, A Lavoura, Boletim da Sociedade Nacional de Agricultura*, XXII, 1918, pp 239-247 Rio de Janeiro -- VI IN-ET INT D'AGRICULTURE, *Les pays cotonniers Leur production et leur mouvement commercial* pp 1-143 Rome, 1922 -- VII DE CAMPOS, D., *Rapport sur la statistique du coton présentée à l'Assemblée générale au nom du Comité permanent*, pp 1-15 Rome, 1922 (VI Gen Assembly, 8 May 1922, No 8) -- VIII *Conferencia internacional Algodoeira promovida pela Sociedade Nacional de Agricultura Estatutos, Proclamação*, pp 1-16 Rio de Janeiro 1922 -- IX *La Conférence internationale cotonnière de Rio de Janeiro (Oct 1922) Communication faite au Comité permanent de l'Institut international d'Agriculture* by DE CAMPOS D pp 1-9 Rome, May 31, 1922 -- X *Annuaire international de Statistique agricole 1917-1918* Rome 1920 -- XI *COMITÉ PERMANENT DE L'INSTITUT INTERNATIONAL D'AGRICULTURE (Process-verbaux)* 1920, pp 85-90 Rome, 1921

Cotton is incontestably one of the all important crops in world agriculture. Problems associated with production have therefore a high international importance and necessitate a unity and co-ordination of effort between every country concerned, from the standpoints both of production and consumption.

In 1905 an International Congress was held at Liverpool and Manchester, and as a consequence the International Federation of Master Cotton Spinners and Manufacturers' Association was established. This Federation calls meetings periodically and publishes the records and issues every six months the statistical data for the cotton stocks in the factories, February 1 and August 1 of each year as well as the cotton statistics for the half-year period, January 31 to July 31, and August 1 to the following January 31. This Association is limited, however, to the spinners and is not universal, as the American Association stands apart.

1ST INTERNATIONAL COTTON CONFERENCE (New Orleans, October 13-16, 1919) (I) -- The advantage of a World Cotton Conference was urged by the Americans with a view to supplying the gaps and making good the inevitable incompleteness arising from entire dependence on the International Federation of Master Cotton Spinners, which confines its attention to certain sides of the cotton question only.

The Conference was held in New Orleans, one of the chief cotton growing centres in the world on October 13-16, 1919. For the first time on record, the discussions of cotton growers, and merchants and manufacturers were united and the bases of agreements of fundamental importance were laid.

The programme of the Conference included 14 questions, which may however, be reduced to 10, as follows (II)

- 1) World cotton requirements, increase of the consumption entails increase of production, stability of prices
- 2) Production; selection of the seed; methods of cultivation and picking
- 3) Ginning; uniformity of baling and pressing in bales

- 4) Damage at time of shipment and in transit.
- 5) Transport and insurance.
- 6) Buying and selling; tare and net weight.
- 7) Markets; classification; public interest and speculation.
- 8) Capital, credit and exports.
- 9) International and national reports and statistical returns.
- 10) Permanent organisation of a world conference of cotton interests.

The results of the debates and discussions which took place at the Conference are summed up in the resolutions subjoined here :

1) The Conference desires such a system of cotton sales as to ensure a fair price for the best qualities and the best kinds of this product. Seed inspection must be instituted, and there should be furnished certificates of origin. An enquiry should be undertaken into the best means of combatting diseases of the cotton plant whether due to insects or to other causes: there should be quarantine of seed with the object of preventing the spread of disease. Seed selection must be improved and improvements should also be made in methods of cultivation. A task more difficult to achieve but equally essential is the fixing of the price in relation to the cost of labour. To do this an international agreement should be arrived at between producers, as it is on them that the burden falls of the higher wages that increase the cost of production. It will not be easy to lay down the principles governing such an agreement owing to the presence of a large number of factors, among others the extremely complex factor resulting from the fluctuations of the exchange.

2) American manufacturers have expressed the desire to see the southern planters devote themselves exclusively to the question of improving the quality and yield per hectare. It is absolutely essential to proceed so as to ensure an annual production corresponding to the needs of the industry and fulfilling the requirements of the consumer as regards quality.

3) It is essential to introduce generally the American grading of cotton both for the manufacture of, and the trade in cotton. It is also absolutely essential to adopt an *hora certa* for the publication of prices on all the American markets for spot sales. The unification of classification is a pressing necessity if an absolutely standard result is to be obtained, as serious difficulties are encountered when trade figures of different countries are compared.

4) The Conference recommends that the different countries continue, pending an enquiry into the best means of establishing a uniform system of organisation of statistics, to collect and publish statistics of exports and imports, of production and consumption, encouraging efforts of this kind from whatever quarter, and acting jointly for common ends.

5) The Conference congratulates the management of the United States Railways on their employment for up-country stations of freight-notes in respect of consignments intended for foreign destinations.

6) The Conference signifies its approval of the State aid given by the American Government to the transport of cotton by river navigation.

7) Bales, packages, or small bales containing cotton, silk fabrics

or silk and cotton fabric must be securely packed and well protected, so as to avoid mildew which causes serious loss to the dyers and printers.

8) The Conference states that it is incumbent on the Government to find the means to prevent losses caused by exposure to bad weather and it calls upon the competent authorities for effective action in this direction.

9) The Conference is strongly of opinion that warehouses should be erected at the quays and storage places so as to avoid losses caused by bad weather. Warehousing in suitable localities for keeping cotton will be encouraged. Working of these depots: storage charges, charges for weighing and grading to be kept low. Credit guarantees to the advantage of world trade; equally for producers and buyers.

10) The Conference recommends that a law be approved authorising the " War Finance Corporation " to issue bonds to enable purchases to be made under the best possible conditions in the United States of the raw materials necessary for the resumption of manufactures in the purchasing countries. These bonds will make possible the automatic regulation of foreign manufactures and organisations if they are accepted by the foreign banks and approved by the Governments of these countries. The law further declares that in order to assist the " War Finance Corporation " the banking and credit organisation already existing in the United States shall also be available for furnishing the funds necessary for the bank operations intended for the purchases of raw materials, and that about a thousand million bales of cotton or other main products should be put at the disposal of the European industries so as to enable them to recommence work.

11) A permanent Council or Committee of the Conference has been instituted and several sub-committees appointed: the principal task of these is the consideration of American production and manufacture. A general assembly of the members of the Committee and of its sub-committees will be held at Manchester in 1921.

One of the most important results of the Conference is the demonstration of the insufficiency of the world production of cotton, and an appeal it made for more intensive and improved methods of cultivation and for improvement in quality.

II. WORLD COTTON CONFERENCE (Liverpool and Manchester, June 13-22, 1921) (III). — The second great international conference was held in two sections. The first, June 13 to 15, at Liverpool, world famous as a cotton port and the seat of the leading cotton exchange in the world, dealing with the affairs of the 570 members of the Liverpool Cotton Association. Liverpool is also the Headquarters of the Tribunal whose decisions as regards the cotton trade are accepted throughout the world. At this Conference, questions of raw material were discussed and consequently also production, prices, sale methods and the best means of encouraging the importation of American cotton into the poorer European countries.

The following summary has been made of the addresses given :

D R COKER stated that at the existing prices viz. 15 cents per lb, neither land-owner, nor the cultivator finds it profitable to grow cotton. This was confirmed by TREVOR TROUGHT, Minister of Agriculture, Egypt.

W H HIMBURY, General Manager British Cotton Growing Association summarises the latest information as regards the development of new cotton fields within the British Empire, noting especially Nigeria, Uganda and the Sudan.

In Nigeria, the crop in 1920 was 16 100 bales (of 400 lb) for shipment, it is estimated, however, that 100 000 bales might be obtained, in Uganda, where 16 years ago cotton was unknown, the crop in 1920 is estimated to have reached 52 000 bales, it is expected that an increase of 20 % annually is possible, in Sudan, 22 000 bales were produced with a possible increase to 1 500 000 bales.

W R MEADOWS, representative of the U S Department of Agriculture brought forward a proposition to the effect that universal standards be adopted for American cotton.

Other addresses dealt with financial and commercial problems.

The second part of the Conference was held at Manchester on June 15-22. Manchester is the great manufacturing centre and employs 60 million spindles and 800 000 looms standing therefore as the chief world centre as regards fabrics and yarn. Questions relating to the cotton industry were discussed and the resolutions and decisions of the Conference as a whole were approved.

Among the most important addresses may be mentioned the following:

W HOWARTH on the 'Characteristics of cotton as required by the spinner', W DAVIS 'Quality and nature of cotton yarn used in the hosiery trade', S H HIGGINS and A HODGI, 'Preparation of cloth for finishing', A I HOLT, 'The cotton mill, its machinery and equipment', A WATSON, 'Transportation of cotton', A L SCOTT and BLANCHARD F S, 'Needed reforms in the ginning, baling and compressing of Cotton', J JACKSON, 'Factory accidents and their prevention', A THOMAS (Director of the International Labour Bureau), 'Hours of labour and the textile industry'. The disadvantage of the 8-hour system from the English spinners standpoint was discussed, with reference to the resulting decrease in production.

Dr A W CROSSLEY delivered an important address on the scope of the British Cotton Industry Research Association, which includes 1500 branches and has established a Scientific Research Institute with the following aims: a) study of the botanical and chemical and physical properties of cotton fibre, measurements, resistance, elasticity etc. of yarns, effect of climate and moisture on quality of lint, b) weaving and steaming problems, c) tendering of fabrics by acids, heat and light.

Resolutions were put forward in the various sub-Committees, 14 in number and dealt with the following subjects — 1) cotton growing, 2) ginning, 3) seed, 4) compressing and warehousing, 5) sales and purchase, 6) transportation, 7) banking and insurance, 8) spinning, 9) ma-



manufacture of fabrics, 10) sale of goods, 11) finishing, 12) research and statistics, 13) textile machinery, 14) cotton waste

The following important resolutions have been selected for quotation

1) Resolution of Committee I that growers should organise a Society of the Cotton growers of the world consisting of members directly interested in cultivation, and statistics etc to promote world wide improvements in the quality of the crop, the methods of preparation and handling and the establishment of equitable prices

2) The Resolution of the Compressing and Warehousing Committee, emphasising the need of reforms in the methods of handling cotton in the United States and recommending that closer and more frequent contact should take place between the representatives of the mills growers and merchants in order to improve the classification of cotton, its protection on the farms and at the ginneries etc and also that adequate warehouse accommodation be provided and high density encouraged without injury to the fibre and the bale contents

3) Resolution of the Sales and Purchases Committee approving the contract system and deprecating legislative interference as tending to impair its usefulness. This Committee recognises the importance of studying the various forms of contract with a view to assimilating any existing differences. It was resolved that a comparison be made between the American and Liverpool official standards

4) Resolution of the Research and Statistics Committee recognising the important functions of the International Institute of Agriculture and inviting the Governments to furnish to this Institute the requisite information at the earliest possible moment in order that it may be promptly made available for the benefit of all producing and consuming countries

COTTON IN BRAZIL (V VI) — Before passing on to the study of the programme of the International Conference which will be held at Rio de Janeiro in the month of October next it may be useful to make a rapid survey of conditions in Brazil as a cotton-producing country making use for the purpose of the material collected on the occasion of the first Cotton Conference organised in 1916 by the "Centro Industrial do Brasil" (in *Revista XXII* (1918) Numero Especial) and of the statistics published by the International Institute of Agriculture (*Les pays cotonniers Leur production et leur mouvement commercial* Rome 1922 provisional edition pp 1143)

Subjoined are the figures of Brazilian production

Years of picking	Area ha	Production q
1915-1916	203 966	611 900
1916-1917	202 775	608 327
1917-1918	294 051	747 154
1918-1919	244 820	714 161
1919-1920	277 356	842 071
1920-1921	325 947	977 842
1921-1922	574 600	1 326 000

The area suitable for cotton growing, according to PLARCF who has travelled throughout Brazil on behalf of the International Federation of Associations of Master Cotton Spinners, may exceed that of the United States

The northern or equatorial cotton-growing region extends from Maranhão to Bahia, both along the coast and inland, and consists of a strip about 240 kilometres wide. The southern region with its centre at San Paulo includes a number of fertile belts extending from 15 to 25 degrees of south latitude.

In the north sowing is from December to January for long-staple cotton (from 28 ½ mm and more), and from February to April for short-staple cotton (less than). In the south sowing is from September to November.

In the north picking is from August to December, in the south from March to May.

The best variety is the *Serido* or *Moce*, with a long staple of 35-45 mm and it is chiefly grown in Brazil at Parahyba and at Rio Grande do Norte.

The quantities of long and short staple cotton respectively grown in recent years, are (VII)

Years of picking	Long-stapled cotton (8 ½ mm and over)	Short-stapled cotton (under 28 ½ mm)
	l	qs
1915-1916	358 000	253 900
1916-1917	352 851	255 476
1917-1918	433 400	313 754
1918-1919	425 088	308 474
1919-1920	480 000	350 000
1920-1921	567 240	410 760

The enemies of the cotton plant are very numerous in Brazil. The pink boll-worm (*Platyedra gossypiella*) is the most formidable. Where the growth is very thick it is difficult to combat destructive insects. The officials and experts encourage the cultivators to sow new belts and to change the order of the crops. Good results have been obtained in localities where these methods have been adopted.

Subjoined is the quantity of cotton ginned and prepared in the Brazilian factories.

Years	Quintals	Years	Quintals
1911	457 380	1914	455 150
1912	483 630	1915	573 700
1913	465 720	1916	601 220

At the date of the Rio Cotton Conference, held in 1916, the average requirements of that year were more than 605 000 qs and they were fully met by the Brazilian cotton.

After the conference the increase in the home consumption was as follows :

Years	Quintals	Years	Quintals
1917 . . . . .	686 420	1919 . . . . .	700 000
1918 . . . . .	714 400	1920 . . . . .	705 000

The exports of ginned cotton reached the following figures in the last decade :

Years	Quintals	Years	Quintals
1911 . . . . .	146 469	1917 . . . . .	59 411
1912 . . . . .	167 739	1918 . . . . .	25 942
1913 . . . . .	374 236	1919 . . . . .	121 531
1914 . . . . .	304 342	1920 . . . . .	246 961
1915 . . . . .	52 276	1921 . . . . .	196 070
1916 . . . . .	10 709		

The yield per hectare of ginned cotton has been as follows :

Years	Quintals	Years	Quintals
1915-1916 . . . . .	3.0	1919-1920 . . . . .	3.0
1916-1917 . . . . .	3.0	1920-1921 . . . . .	3.0
1917-1918 . . . . .	2.5	1921-1922 . . . . .	2.3
1918-1919 . . . . .	3.0		

This yield has always been higher than that of the United States.

The imports of cotton into Brazil have been very small, except in 1916, as may be seen from the following table :

Years	Quintals	Years	Quintals
1909 . . . . .	169	1916 . . . . .	76 238
1910 . . . . .	1 219	1917 . . . . .	1 863
1911 . . . . .	2 590	1918 . . . . .	43
1912 . . . . .	2 108	1919 . . . . .	98
1913 . . . . .	589	1920 . . . . .	101
1914 . . . . .	1 416	1921 . . . . .	—
1915 . . . . .	1 267		

**THIRD INTERNATIONAL COTTON CONFERENCE (Rio de Janeiro, October 1922) (VIII-IX)** — The third International Cotton Conference arranged by the National Agricultural Society, and under the auspices of the Executive Committee of the National Exhibition and of the Department of Cotton of the Ministry of Agriculture, will be held in October 1922 at Rio de Janeiro.

It is clear from the preceding notes that cotton growing and the cotton industry hold a very important place in the economy of Brazil. The eyes of the English manufacturers have long been turned on this country, which is almost certain to become the largest cotton growing region in the world and one of the most important sources of supply of the raw material.

The programme of the International Conference (at which will be present undoubtedly all the growers and all the manufacturers of cotton in the world) includes ten enquiries or groups of leading questions:

*I) Cotton in Brazil. General enquiry into the cultivation of the cotton plant in the different States of Brazil and in other countries.*

- 1) Varieties of cotton in the different States of the Union. Characteristics of these varieties. Studies of the seeds and the quality of the fibre.
- 2) Advantages and disadvantages of annual and perennial varieties according to the topographical and climatic conditions and the nature of the soil. Disadvantages of mixing different varieties in the same plantation. Importance of establishing a system of cultivation with a single variety for each zone.
- 3) Proved yield for each variety.
- 4) Resistance of the different varieties to weather and to the diseases of the different regions.
- 5) Early maturity and productivity of the different varieties in each region.
- 6) Soils best suited to each variety. Topographical aspect, geological formation, chemical constitution of the soil and extent of each region. Examples of the best lands. Local climatic conditions.
- 7) Methods of production in each region, labour conditions, day labour with payment in kind or piece work, price of land, facilities for transport.
- 8) Retrospective study of the development of mechanical cultivation, with animals and tractors, all over the country.
- 9) Retrospective study of State and private action for the encouragement of the cultivation of the cotton plant in the country.
- 10) Statistics of cotton production in each State, if possible by municipal areas, exports to the different States and exports abroad.

*II) Improvement of the cultivation of the cotton plant in Brazil.*

- 1) Preparation of the soil, trenching, processes of tillage and raking, use of tractors and economic conditions of the operations.
- 2) The most economical systems of planting and the machinery to be used. Periods and methods of planting, according to the varieties and regions. Restocking, lopping, levelling.
- 3) Enriching or poor soils. Use of cotton refuse, of manure, and of chemical and other fertilisers.
- 4) Rotation of crops and need for regulating these so as to ensure both soil fertility and the control of plant diseases.

- 5) Picking, precautions to be taken to obtain the cotton pure. Storage so arranged as to avoid dirt and disease.
- 6) Selection of seed with reference to the variety of cotton and the quality of the fibre; methods employed in these operations
- 7) Acclimatisation of exotic varieties: advantages and disadvantages
- 8) Comparative study of the selection of Brazilian varieties and of the acclimatisation of exotic varieties: superiority of the first system over the second
- 9) Cutting: study of the different methods, their advantages and their economic results.

### III) *Diseases of the cotton plant. State Protection.*

- 1) Study of the diseases and insects which attack the cotton-plant, and particularly the "broca" (*Gasterocerodes Gossypii*), the pink boll-worm (*Platyedra gossypiella*), and the "curuqueré" (*Alabama argillacea*): studies of the material damage caused by each of the above mentioned diseases and pests as regards the quality of the cotton and the yield from the picking. Advantages obtained due to the measures taken by the States that have a department for protection of growers
- 2) Influence of bad weather at the time of planting and picking. influence of the surrounding vegetation, of the variety and of the methods of prophylaxis on the recurrence of diseases
- 3) Methods for combatting diseases. Insecticides, spraying materials and their application. Cutting of perennial cotton plants as a preventive method.
- 4) Cleaning of the seed and methods employed for this purpose, whether heat and exposure to the rays of the sun or carbon bisulphide or hydrocyanic gas. Study of apparatus employed on the large and on the small farms and for export trade. necessity of spreading the use of these. Arrangements for the importing of cotton seed from abroad and installation of apparatus for cleaning.
- 5) Plan of co-ordination of the federal legislation of the States and the Municipalities as regards the methods adopted for the protection of the cotton plant. The most important rules to be observed. Schemes including itinerant lectures and propaganda among cultivators, proprietors of ginning machinery and buyers of cotton
- 6) Measures to be taken to secure common action in the producing countries, with the object of avoiding the spread of the diseases that attack the cotton plant

### IV) *The cotton-plant in the North-East*

- 1) Operations in the North-East for developing and improving the cultivation of cotton and notes on the best methods of carrying them out
- 2) Lands under cultivation and a study of a plan of extension of the areas planted by the construction of large barrage works. Enquiry into methods of utilising and improving irrigated land, low lying land and elevated land by means of barrage constructions.
- 3) Distribution of water for irrigation purposes: rules to be adopted and methods recommended. Quantity of water required by the different crops and the relative charges. Method of procedure for speedy utilisation of irrigated land
- 4) Advisability of employing borrowed capital and utilisation of irrigated land: the best system of working to follow
- 5) Economic capacity of the great irrigation works of the North-East and plans for harbour improvements
- 6) Cultivation of land with large, small and medium barrage works. Enquiry into

the basins of irrigation, and the large canals. Economic possibilities of utilising the water in the great barrage works of the North East for irrigation purposes.

7) Value of the carriage roads in the whole cotton growing region and necessity for increasing their number.

### V) *Treatment and manipulation of cotton and its by-products*

1) Treatment of cotton. Preliminary grading in relation to the quality and kind of staple. Handling, ginning, pressing, baling, warehousing. Improvements to be introduced into the methods employed.

2) Ginning machines. Types of saws, rollers and cutters with notes on their use and on possible improvements. Inquiry into the application of these types of machine to the various kinds of Brazilian cotton, advantage and disadvantages.

3) Central stations for the manipulation of cotton according to kind, to length of staple and to the importance of the region. Conditions which should guide the choice of situation of these stations.

4) Types of cotton presses and their use in each case. High density presses at the ports of shipment and drying apparatus. Cotton warehouses at the ports of shipment. Kinds of bales for export and for home consumption.

5) Baling of cotton and treatment of by-products. Possibility of fraud in connection with these processes and means of prevention.

6) Cotton seed and its preparation. Conditions that must be fulfilled by the seed depots as regards collection, storage and consumption for local use as well as for export.

7) Oil factories. Study of machines intended for treatment of seeds so as to obtain maximum output. Oil, oil cake, residue, linter and husks. Position of the oil mills regarded from the point of view of the raw material, of transport conditions and of the best means of utilising the by-products, their industrial and economic value.

8) Refining of the oil from the chemical standpoint. Oil techniques for the manufacture of food products such as edible fat, table and cooking oils. Commercial importance of these by-products in national economy.

9) Utilisation of the cotton stalks and of the 'linter' in the paper making industry. Facilities to be given to factories established in the country.

### VI) *Development of cotton growing. Federal Cotton Department*

1) Encouragement of cotton growing by means of the primary schools, of co-operative cotton growing, of itinerant classes, experimental stations, stations for production of seed and the assistance given by public authorities to all that concerns the extension of the cultivation and its cost.

2) Encouragement of the extended use of agricultural machinery and facilities for purchase by importation free of duty and sale at cost of manufacture. Extension of similar privileges to machines intended for the manipulation of cotton products, to windmills, to apparatus used in making irrigation canals, to motor engines, to fertilisers and to insecticides used in cotton cultivation.

3) Grant of subsidies for the business of manufacturing cotton and its by-products.

4) Experimental plots attached to plants for the manipulation of cotton, their methods and aims, selection and cleaning of seeds intended for planting in accordance with the most approved methods.

5) Federal Cotton Department, the most suitable form of organisation or propaganda advocating scientific methods of work, protection of the plantations, distribution of selected seed, employment of agricultural machinery, and also the organisation of statistical returns of cotton production.

6) Grants made by public authorities mainly for propaganda, advocating scientific methods of working, and the control of plant diseases affecting cotton. Need for the Governments of the different States of Brazil and the Municipalities to make regulations for prophylactic measures and the protection of the cotton plant against infection. Fraudulent practices in the handling of cotton, in the manufacture and in the packing of the oil : measures directed against those guilty of such practices

7) Need for the establishment of a large number of small factories in inland districts of the States that are cotton producers. Facilities to be granted for the installation of these factories

8) Enquiry into the export of oil-cake : advantages of prohibiting this export. The place of oil-cake in the feeding of livestock

9) Premiums to cultivators employing oil cake as a fertiliser

### VII) *Classification of cotton and standardising of the commercial kinds of staple and of its by-products. The cotton trade.*

1) Need for a classification of cotton staple in order to facilitate buying and selling operations, and the creation of a type by which to check these operations

Methods to be followed in classification :

a) the degree of purity and the best conditions of the staple according to the American classification ; b) origin of cotton and the differentiation of varieties in respect of length of staple, its power of resistance and its fineness

2) Establishment of model types of Brazilian cotton, taking into account the characteristics of the variety, of the high standard degree of the manipulation and of the state of the fibre. Need for the Brazilian experts to work in collaboration with the specialists of other countries for the establishment of these model types and the trade importance of organising on these lines

3) Local exhibitions and markets ; way in which they should be instituted, directed and regulated in the interest of production, so that all concerned receive information as to cotton prices by means of the publication of a bulletin of market prices for all the principal centres in the country. The sale of cotton loose or in pool, testing of weights and balances

4) Co-operative societies for the production and sale of cotton. Credit banks

5) Cotton exchanges, need for their establishment in the principal ports of shipment and the conditions to be laid down for the organisation and regulation of the sale and purchase transactions in cotton and its by-products. State action in agreement with the Exchanges to obviate a classification prejudicial to the producer. The cotton trade and an enquiry into the class of agents and middlemen "Warrants" for cotton and its by products.

6) Establishment of types for the by products of cotton and of regulations in view of their utilisation both as food and commercially

7) International joint action for the improvement and increase of cotton production regulations relating to the settlement of trade disputes

### VIII) *Spinning and the textile manufactures. Home consumption of cotton. Export of material*

1) Enquiries into the Brazilian spinning and textile industries. The raw material used in them and their importance in the national economy. Practical methods of encouraging, by means of a keen foreign propaganda, the sale of Brazilian textile materials. Questions relating to the quality and condition of the cotton. Means of remedying defects observed. Statistics of spinning and textile manufactures. Means of getting these into line with international statistical returns

2) History of the development of spinning and weaving in Brazil, of the fluctuations

of stocks and of the prices of raw materials. Enquiry into the best methods of stabilising the conditions of industrial life : influence of export duties and of the exchange. Need for export of material for the attainment of commercial stability.

3) Joint action to be undertaken between the cotton industries and the Federal Government, together with the Governments of the different States of Brazil, for the development of production, for the control of plant diseases and for the improvement of the industrial processes. Report on the activity of the British industries especially in the Protectorates and in the colonies.

### IX) *Economic protection of cotton.*

1) Action taken by the Brazilian Union and by the cotton-producing States for the economic protection of cotton with a view to preventing too rapid fluctuations in price.

2) The fluctuations of the exchange and their influence on cotton prices and the prices of the by-products. Methods of ensuring regularity in home prices.

3) Fixing of the minimum price by special legislation. Advantages and necessity of such fixing for Brazil. Report on the British colonies where this procedure has been adopted.

4) International reserve of cotton. Stability of prices in the foreign markets.

### X) *Export of cotton and of its by-products. Duties and freight-charges.*

1) Desirability of reducing export-duties on cotton and its by-products and of making such duties uniform, with the object of improving the exchange and stimulating production. Differential duties in proportion to the amount of manipulation and the degree of the purity of the product. Enquiry into the substitution for export duties of other more equitable taxes likely to encourage the investment of capital in cotton growing and in its manipulation or manufacture. Suppression of customs and similar duties.

2) Reduction of the export duty for pure cottons, baled and graded into trade classes. Measures to be adopted in respect of impurities or fraud.

3) Municipal taxes on cotton. Ways of finding effective and convenient substitutes without hampering production.

4) Enquiry into the advantages direct and indirect of the intervention of the Union in favour of the development of cotton exports. Economic limits of the export of cotton and its by-products in view of international balance of trade.

5) Export of cotton and its by-products for world consumption and means of assuring a progressive development. Specialisation in the export of longstapled cotton as the best means of obtaining a stable high prices.

6) Establishment of new markets abroad for developing the trade in the Brazilian long-stapled varieties, with the support of the Chambers of Commerce and Cotton Exchanges. Need for basing this policy of development on improved and extended production and on the organisation of export in bulk, in accordance with the rules laid down for international trade.

7) Transport of cotton and its by-products by carriage, roads, railways, rivers and by sea. Enquiry into suitable methods of reducing and standardising freight charges, and the joint action necessary to this end. Differential tariffs according to the degree of compression of the cotton and the distances from export centres.

8) Safe methods of transport by land and sea for cotton and its by products, from the ginneries up to their arrival at the manufacturers.

Such is, in its complete form, the extensive programme of enquiries and discussions which will engage the attention of the Third International Cotton Conference to be held in October next, in Rio de Janeiro.

F. C.



829 — **Problems of Cotton Planting.** — See Article by Dr FR. CORTESI, p. of this *Review*.

830 — **Principal Vines Grown in Dalmatia.** — BULIC, S., in *Rivista di Ampelografia*, Vol. III, No. 5, pp. 73-74; No. 6, pp. 81-84. Alba-Leghorn, May and June 1922.

VINE GROWING.

Up to the middle of the 19th Century vine-growing in Dalmatia was almost entirely confined to the central part of the littoral and the neighbouring islands.

The two extreme coast districts, Zara and Cattaro, and the whole of the Mediterranean part did not even produce enough to satisfy the requirements of well-to-do people. Since that time, it may be said that there are in each vineyard many qualities of grapes, mostly red, producing wines differing little from those of Apulia and Sicily.

The development of vine growing and the selection of stock got their first impetus from the appearance of oidium in Lombardy-Venice in 1848-1850, which increased 9 or 10 fold the price of Dalmatian wine on the Venice market. This caused the almost total disappearance from the Dalmatian vineyards, of many of the most highly reputed stocks (Malvoise blanc de Raguse, Muscat rose d'Almuse) or else their growth was much reduced (Ungara blanc de Bruzza, Maraschina blanc de Sebenico), they were replaced by productive stocks of red grapes which were very resistant to oidium, which, however, never caused much damage on the dry rocky soils of Dalmatia.

From 1866 to 1878, the wines suffered a crisis owing to the annexation of Lombardy-Venice to Italy, the consequence of which was the loss of this market, and enormous duties imposed on Dalmatian wines for their importation into the other Austrian provinces.

The revival of the Dalmatian wine industry is largely due to LIEBENFROST. During the campaign 1870-71, he began to make high-grade wines at Castella, near Spalato, at Sebenico and at Zara for his important firm; the export which had been 6000 barrels (of 66 litres) in 1870, was 75 000 barrels in 1871. On the initiative of the same manufacturer, wine companies were immediately formed at Spalato, Zara, Civitavecchia de Lesina, and at once did good business.

For 12 years after 1878 there was a heavy export of Dalmatian wines to France (where the phylloxera was raging), to Germany and to Switzerland, and the prices increased considerably; consequently in about 10 years Dalmatia was "transformed into a vineyard" under red wine producing varieties. The growth of white stock was reduced to a minimum and of the former 200 kinds, only traces represented by a few vines remain. The present number in ordinary use is reduced to 4:— "Plavac mali" (small red Plavac), "Plavina" (red Plavina), "Nincusa" (red Nincusa) and "Kadarun" (red Cadarun); the writer gives for each of these vines:— extent of cultivation, synonyms, description of the plant, cultural data, value of the grape and wine.

There are, besides also about 10 secondary kinds.

F. D.

831 — **The Question of American Stock for the Vines of the Trentino** (1). — J. CACCIATORE, M. Sul comportamento dei portinnesti americani nel Trentino ed in particolare nei vigneti dell'Istituto agrario di San Michele all'Adige, in *Bollettino del Consiglio provinciale di Agricoltura etc del Trentino*, year XXV, Nos. 7 & 8, pp. 181-187. Trent, April 15-30, 1922. — II. GRAMMATICA. Sull'influenza del ceppo americano in rapporto alla qualità del vino. *Ibidem* pp. 101-117. — CATONI G. and GUSTOLINO A., I feligni predominanti nel Trentino in *Giornale vinicolo italiano*, year 18, No. 6 pp. 53-54. Casale Monferrato 1921, 5, 1.

The two former articles are complementary inasmuch as the first deals with the value of the different stocks from the vine grower's point of view and the second from the wine maker's standpoint.

I. — Review of the result given by American stocks in Trent and particularly in the vineyards of the Agricultural Institute of St. Michael, on rather calcareous soil (6.13% by BERNAKID'S calcimeter) partly compact clay and partly clayey sand fairly friable and subject to drought. From these results the writer draws the following conclusions: — 1) the hybrids Riparia × Rupestris 101/14, 3309 and Schwartzmann should be preferred, the first two because they do well in soils of various types such as those of the experimental vineyard, the third because it seems to adapt itself even to hilly ground too heavy and dry for Riparia, 2) the hybrid Riparia × Berlandieri Teleky which appears to adapt itself well to various soils, (3) the hybrid Rupestris × Berlandieri Teleky which appears to be worth propagating in dry poor hill soils, (4) the hybrid 420 A (Riparia × Berlandieri) which is well suited to stony dry calcareous hill soils, and the hybrid 3306 (Riparia × Rupestris) which should be tried in somewhat heavy, fairly moist, clayey calcareous soils.

It is only with great discretion that pure Riparia, pure Rupestris and the European American hybrid G. N. 1 can be recommended, there is also no reason to grow extensively the hybrids 1202 and 41 B, which might however, render good service if an opportunity should present itself of profiting by their peculiarities of adaptation without decreasing their vigour.

The Provincial Agricultural Institute of St. Michael and the Trent Provincial Council of Agriculture have been charged in recent years with the study of the selection of vines for the fresh planting rendered necessary by the destruction caused by the war and by phylloxera.

The problem cannot have a single solution, because in the valleys it is desirable to aim rather at abundant production and in the hills at superior quality. The results obtained by the Institute may serve as a guide to the vine grower after he has decided whether he should go in for quantity or quality.

The renewal with American stock was begun in 1906 in the vineyards of the Institute and ended in 1913. Numerous American stocks, especially for the vines most commonly grown, Schiave, Negrara, Teroldigo, Cabernet, were used for the purpose of studying the behaviour of different stocks in relationship to soil and varieties of local vines.

(1) See R. MARCHETTI, No. 52, R. JULY 1921, No. 28, R. OCT. 1921, No. 1012. (Ed.)

II. — The great majority of the new plantations are not inferior from a wine making point of view, to the old ungrafted vines. In the first place, the wines of Burgundy type made from red Pinot, Gamay, Molinaro, and San Lorenzo show a notable improvement, especially in aroma and fineness of bouquet.

The results of the new plantations of Cabernet are less satisfactory; the wines which have been obtained from them are much superior to those from the same ungrafted vines, but they lack bouquet. The fact that the method of ground growth had been replaced by pergolas, may perhaps have contributed to this result.

The quality of the wine has not deteriorated in the different varieties of Schiava, Teroldigo and Lagrein; but there is no doubt that in the case of Negrara it has suffered.

The white wines (white Pinot, Sanvignon, Traminer, Riesling), have maintained the high qualities of the old ungrafted vines. The writer advises a larger use of them in the renewal of vineyards at medium elevations; he also recommends the partial replacement of the white Vernaccia on the good soils of the Val d'Adige by red and white Veltliner, Sylvaner and Ruländer or grey Pinot, the must of which is very suitable for the manufacture of sparkling wines.

To prove the influence of the stock, the writer has made wine separately from grapes produced by the same vine on different stocks and has analysed the wines obtained.

A series of tabular statements show the results of these analyses. The highest quality was obtained from produce of *Riparia* × *Rupestris* 101/14 and *Rupestris*; followed, in decreasing order, by *Riparia*, *Riparia* × *Rupestris* 3309, Schwarzmann, Aramon × *Rupestris*, *Riparia* × *Berlandieri* Teleky.

III. — Among the numerous vines grown in Trent the following predominate: — *red grapes*. — Teroldigo, typical of the Atesina valley; Marzemino, especially in the Rovereto zone, late in ripening and yields fruit even on poor soils; Negrara, throughout Trent; Gropello, typical of the Non valley; red Schiava or Schiavone, almost throughout Trent, but especially in the Sarca and Cembra valleys; Rossara, throughout the Atesina valley; Pavana, native of Italy and grown only in Valsugana until a few years ago; as it resists oidium it was then brought into the territories of Trent, Rovereto and Civezzano;

*White grapes*: — Vernaccia, the most common of all; Nosiola, much better than the former; Trebbiana, the growth of which is only important in the Sarca valley; Riesling Italico, introduced some years ago into the Adige valley.

In consequence of the work of the Trent Council of Agriculture and district Agricultural associations and their affiliated societies and by the provincial Agricultural Institute of S. Michael, there is a tendency to limit the growth of Schiavone, Rossara and Pavana, which yield common wines, and to replace them by vines giving better wine, such as: — Veltliner, Bourgogne, Sylvaner, grey Pinot, Sauvignon, Muscat, Traminer, Riesling

of the Rhine, Bourgogne of the Rhine, Molat, Verdot, Cabernet-Sauvignon, etc. F. D.

## FORESTRY

832 - **The Renewal of Chestnut Woods in France.** — MANGIN, I., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 8, No. 7, pp. 144-151. Paris, Feb. 15, 1922.

The chestnut woods, which formerly covered the Plateau Central and the Cévennes, and which were a source of wealth, disappeared as means of communication increased and made possible the growth of cereals; also because an export market is lacking on account of the poor quality of the fruit which has not been improved by selection. The profits of the chestnut woods have become so small that many proprietors do not hesitate to sell the trees to tanning extract factories and do not trouble to replant the cleared areas. To these causes must be added the damage caused by the "maladie de l'encre", which has denuded large extents of chestnut woods in many Departments.

In some twenty Departments, in which the chestnut woods have been replaced by more remunerative (sometimes four fold) crops, the question of renewing them does not exist. But in some ten Departments their disappearance is an actual loss, either because the soil is not suitable for more remunerative crops, or because want of labour does not permit of the cleared areas being brought under cultivation. Where clearing has been the work of man, indigenous chestnuts may be transplanted, the best varieties being chosen: they continue to fruit up to 50-60 years, and it is well to have them standing to that age, because it is then that the wood acquires its highest tannin content. On the other hand in the zones devastated by the "maladie de l'encre", the soil is infected and fresh plants are attacked by disease in their turn. The author has tried to disinfect the soil by watering the holes dug for the transplants and the earth dug from them with 20 % solution of ferrous sulphate and the results are encouraging. Another means consists in growing exotic chestnuts which resist the disease; such are the Japanese varieties of *Castanea dentata*, introduced about fifteen years ago by Prof. PRUNET of Toulouse University. But it is difficult to procure pure-bred plants of the best varieties; furthermore, the plants resist the disease but do not grow very large, nor do they possess the qualities required by the market. Another difficulty has arisen to complicate the problem of the renewal of the chestnut woods with exotic plants: for some years the woods in the United States have been devastated by a much more formidable disease than the "maladie de l'encre"; it is caused by the ascomycete *Endothia parasitica*, which develops on the trunk and branches and rapidly kills the tree. The American botanist C. L. SHEAT has proved that this mould exists also in China and Japan, but does not cause much damage, while introduced into the United States it has become virulent and has there caused the destruction of many chestnut woods. To prevent this new disease from being introduced into France with varieties of Japanese chestnuts, the Minister of Agriculture has prohibited the entry of Japanese

plants and fruit. This prohibition has been temporarily suspended only for the consignments of the MILVILLI mission, these consignments will be collected in the COUDRE nursery garden at Aubenas, and submitted to a serious examination. It is forbidden to distribute the plants without the approval of the Department of Plant Diseases. In America the Department for the protection of plants is searching for species or varieties resistant to *Endothia parasitica*. *Castanea mollissima* (C. Duclouxi), very common in China, has shown itself very resistant, and already in the United States nurseries have been arranged to fill with this species the blanks caused by *Endothia*. The improvement of the produce by grafting might be tried. Such is the programme which was submitted to the Commission of renewal of chestnut woods which is sitting at the Ministry of Agriculture. In the discussion (Messrs DE VIMORIN, GUIGNARD, HICKLI) which followed that communication the speakers called attention to the fact that grafting exotic chestnuts in France is of recent date and that fruit has not yet been obtained. There has therefore not yet been time to judge the results. It was also mentioned that it is difficult to obtain seed from China and Japan and especially plants in good condition. Packing is more difficult than was imagined. If the chestnuts are beginning to germinate they must be treated with great care. However M. HICKLI announced that he had received from China 7 or 8 years ago Chestnuts in excellent condition and which produced plants without any trace of disease. They were of large size similar in every respect to Lyon Chestnuts. M. HICKLI has also furnished proof of the introduction into France, many years ago, of the chestnut tree from China and Japan.

L. V.

#### LIVESTOCK AND BREEDING

83, - **Poisoning by Green Carobs, in Italy.** — DI PAOLA P. in *Bollettino Ueterinario Italiano* Vol. XVIII No. 154 pp. 65-66; bibliography of 11 works. Turin May June 1922.

HYGIENE

In the district of Gieti (Italy) and in the neighbouring communes the carob tree (*Ceratonia siliqua*) is largely grown, its fruit constitutes with hay and grass the basis of the food of horses, and gives rise to a local trade of some importance. If the carobs are fed sound and quite ripe they form a rich (30-40% of sugar, 20-37% of starch) and digestible food, but if green they may cause poisoning as the author has noted in some cases. The following are the symptoms of the poisoning — diarrhoea, lowering of the body temperature, cynosis, trismus. The treatment is of doubtful efficacy: the writer tried hydropathy, rubbing with camphorated spirit, the administration of a tepid infusion of coffee or injections of caffeine.

The toxic effect of green carobs must be attributed to tannin which acts particularly on the circulatory system causing cerebral hyperhemia, and on the nervous system causing hypothermia.

Hungry animals should not be kept near carob trees laden with green fruit at a height which the animals can reach.

F. D.

- 834 - **Colloidal Sulphur in the Treatment of Sarcoptic Mange in Horses** — SANI, I. and BELLUZZI, G. (Istituto de Patologia e Clinica medica veterinaria della R. università Bologna, in *Il Moderno Zootetto*, scientific section 1st Series, Year XI, No. 1, pp. 11-19, di bibliography of 33 works. Bologna, Jan. 1922.

The authors as a result of their experiments advise the use of colloidal sulphur in the treatment of sarcoptic mange of horses, which they especially recommend for intra-venous, sub-cutaneous and intra-muscular injection, in conjunction with some ointment or liquid acaricide. It exerts a beneficial influence on the general condition of the horse, and acts very energetically in the destruction and elimination of the acarides, and assists in healing the skin; the injections have no bad general effect and are easily carried out, and their cost is very low. By adopting this treatment animals are able to return to work from five to fifteen days sooner than is the case when other methods are employed. P. D.

- 835 - **Spirillae, Pathogenic Agents of Contagious Abortion in Germany** (1). — GUINDER, A. (aus dem Württembergischen tierärztlichen Landesuntersuchungsamt in Stuttgart), in *Berliner Tierärztliche Wochenschrift*, Year XXXVIII, No. 10, pp. 184-185, Berlin, April 20 1922.

In England, the United States and Denmark several writers (2) have drawn attention to the fact that in the case of contagious abortion, bacteriological examination does not always show the presence of BANG's bacillus and that the latter is sometimes replaced by spirillae which then appear to be the decisive agents of the disease. The author describes briefly the first two cases of this form of contagious abortion which have been observed up to the present time in Germany.

Two foetus were concerned one of 4 and the other of about 7 months, which showed few and non-characteristic anatomo-pathological injuries; the result of the microbiological examination was doubtful in the first case, while, in the second, preparations made by rubbing the gastric contents showed numerous short spirillae staining with Giemsa, as well as with LOEFFLER'S solution of methylene blue which was allowed to act for 2 or 3 minutes on the air-dried preparation, their shape and size differed little in the preparations taken direct from the foetus and in those obtained from cultures on agar with the addition of a few drops of defibrinated blood of rabbit or horse. In the former comma shaped (vibrions) and short spirillae with two or three cilia at most were found; in the latter long spirillae were seen having very often 5-10 cilia and more. The experiments of transmission by sub-cutaneous injection of the culture of the spirillae gave positive results, by causing artificial abortion in guinea-pigs with young. It is well to draw attention to the practical importance which spirillary infection, in the absence of infection by BANG's bacillus, may have in the pathogenesis of contagious abortion. E. F.

(1) See *B.* July 1922, No. 731. (Ed.)

(2) See C. O. JENSEN, FADYFAN and STOCKMAN, TH. SMITH, and M. S. TAYLOR, A. THOMSEN (quoted by the author)

- 836 - **Cases of Contagious Abortion in Cows without Demonstrable Cause.** — TRAUM, J., and HART, G. H., in *Journal of the American Veterinary Medical Association*, Vol. LXI, No. 1, pp. 15-30. Washington, April 1922.

The authors believe that most cases of contagious abortion in cows are due to the presence of *Bac. abortus* Bang, though in the five instances described in their paper they were unable to find *Bac. abortus*, or any other micro-organisms of pathological significance.

In a herd of some 50 head (which in 1920 had given negative results when subjected to the agglutinating test for *Bac. abortus*), five cows aborted between September 1920 and September 1921.

An examination of the foetus was possible in three cases only, the organic fluids and solutions from the tissues were sprinkled on special cultural media, but the authors were unable to isolate any definite micro-organism. Transmission experiments were made on numerous guinea-pigs but these, as well as the microbiological investigation of the milk from the diseased cows, only yielded negative results.

It should be mentioned that in two cases out of five, the abortion took place 10 and 20 days respectively after a bimanual manipulation of the reproductive organs made with the object of determining pregnancy. There is thus good reason to believe that this operation together with other unknown factors may have been instrumental in producing abortion. Hence every precaution should be taken when this method of diagnosis is adopted.

E. F.

- 837 - **The Treatment of Sterility of Non-Pathological Origin in Cows.** — DAUBLER, E. C., and BARNES, M. F., in *Journal of the American Veterinary Medical Association*, Vol. LXI, No. 3, pp. 251-258. Washington, June 1922.

The authors have treated cows which, although apparently normal in every other respect, showed no signs of heat, and succeeded in inducing the normal cycle of heat periods and in rendering the animals fertile by giving them the ovaries or extracts from the ovaries of sows. Small pieces of the ovaries of healthy sows were administered, two at a time in a capsule which the cow easily swallowed, or a sterilised extract of sows' ovaries was prepared and injected, each cow receiving a subcutaneous injection of the extract of 1 or 2 ovaries. The latter method proved the more satisfactory. The ovarian extracts of commerce failed to produce the desired effect.

F. D.

- 838 - **Diseases of Zebu in Madagascar.** -- See No. 853 of this Review.

- 839 - ***Necator suillus* n. sp., a New Swine Parasite.** — ACKERT, J. E., and PAYNE, F. K. (Agricultural Experiment Station, Kansas State Agricultural College, Manhattan, Kansas), in *Journal of the American Veterinary Medical Association*, Vol. LXI, n. s., Vol. 14, No. 2, pp. 186-188, bibliography of 4 works. Washington, May 1922.

The authors found at Trinidad (British West Indies), a swine parasite very similar to the hookworm (*Necator americanus*), that attacks man, but forming a distinct species to which they have given the name *N. suillus*. This parasite is usually met with in the ileon or the jejunum and a single

individual may harbour several hundred of these worms. The host become greatly emaciated and therefore *N. suillus* is of considerable economic importance (1).

840 - **A Disease of Young Pigs consequent on Dry Years.** — MOUSSU, G., in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VIII, No. 18, pp. 534-541. Paris, 17 May, 1922.

Study of osseous cachexy of young pigs aged 2 to 5 months. Clinically, the disease is characterised by the following stages:—

- (1) Stopping of growth and difficulty in walking (period of the disease called the squalor period);
- (2) articular deformation and walking on the knees (gout period);
- (3) deformations of the skeleton and of the head;
- (4) final decay, the sick animals die of starvation.

The first stage only lends itself to therapeutic intervention, in any case of doubtful value.

This disease may break out any year and occurs chiefly in certain regions (Aube, Marne, Yonne, etc.), but consequent on dry years, it spreads a little everywhere, except where the pigs are regularly run on pasture. A ration given at too early a stage, composed of a large proportion of farinaceous matter, without dairy refuse, vegetables, roots and green fodder, favours the disease. Up to date, no micro-organism capable of reproducing the disease has been isolated, but the writer has shown, a long time ago, that it may be reproduced experimentally by direct contagion and by starting with emulsions of the diseased osseous marrow.

Treatment recommended by the writer:— 1 gramme of chloral per day per 10 kg. of live weight, in the rations, as anodyne to the painful condition and as general antiseptic; sometimes hydrochlorate of ammonia as a stimulant to nutrition; salts of lime (phosphates, bi-phosphates, carbonates, chloride of calcium, etc.) to facilitate the osseous recalcification.

F. D.

#### FEEDS AND FEEDING

841 - **Calculation of the Money Value of the Nutritive Unit.** — DECHAMBRE, P., in *Revue de Zootechnie*, No. 5, pp. 410-417. Paris, 15 Feb. 1922.

An attempt is made to strike a balance between the requirements of the animal and the provision of food with the least expense. To do this, the cost price of food stuffs must be compared one with another. The market price of a food should be proportional to its nutritive value. We should therefore take as basis the price of the nutritive unit fixing the quotient of the price of the unit of weight by the number of nutritive units therein contained. If  $P$  represents the price of a kg. of the food,  $N$  the number of nutritive units which it contains, the money value of the nutritive unit,  $V$  would be equal to  $\frac{P}{N}$ .

(1) In 1920 O'CONNOR discovered in pigs at Fumafuti in the Ellice Islands, an *Ankylostoma* resembling the human parasite (*A. duodenale*), but smaller. In 1921 LEGO and REUBEN found *A. duodenale* in swine in North Queensland (Australia). (Author's note).



$N = [\text{Protein} + (\text{Fats} \times 2.2) + \text{non-nitrogenous extracts and cellulose}] \times \text{Productivity.}$

**ENGLISH METHOD.** — The *English Journal of the Ministry of Agriculture* gives opposite the market price of food stuffs used for animals, the price of the nutritive unit. This method may exercise an influence on the market rates by preventing an unfair rise on products whose nutritive value is not in proportion to the current price. In the calculation of units nitrogenous principles are given the coefficient 2.5, as it is generally the protein content which determines the market price of a product. Amount of nutritive units =  $(\text{Protein} \times 2.5 + \text{Fats} \times 2.5) + \text{Carbohydrates}$ . Having obtained this result, the price per nutritive unit is determined and the foods classified in increasing order of value. This information is completed by equally useful tables, giving the distribution of foods in the 4 following categories: —

- (1) Products rich in protein and fats.
- (2) Products fairly rich in protein and rich in fats.
- (3) Products rich in protein, poor in fats
- (4) Products rich in starch, not rich in protein and fats.

More recently the *Journal of the Ministry of Agriculture* presents its information in quite a different manner: the price of the different foods is diminished by the manurial value of the nitrogen contained. The difference between these 2 values is the food value

Price — Manurial value = Food value.

If this price is taken, together with the starch value, it is easy to deduce the value of a pound or kilo of the food under consideration. However, the author remarks that the more our knowledge extends, the less is the value which should be attributed to proteins, as such; quantity becomes less important than quality. These ideas of quality are applicable not only to albuminoids, but also to fats and carbohydrates.

To avoid useless discussion regarding the choice of the coefficient to be attributed to albuminoids, the writer calculates the number of nutritive units by simply adding to the figure representing the percentage of digestible albuminoids and carbo-hydrates, that relating to fats multiplied by 2.2 to take into account their greater calorific value. The figures obtained according to this very simple method, make it possible to estimate the cost price of the nutritive unit in each food, and the nitrogen content which will also be given will enable the value of these foods to be judged according to the object in view.

F. S.

#### 842 — The Insufficiency of Lime and Phosphoric Acid in the Feeding of Animals. —

GOUIN, R., in *Revue de Zootechnie*, No. 6, pp. 526-531. Paris, 15 March 1922 (1)

It has been remarked that dry years are followed by an outbreak of more or less similar affections: — osseous cachexy, osteomalacy, osteoclasty, rickets, gout, rheumatism, etc., having always a common cause: — the insufficiency of mineral matter in the bones. Now, as the year 1921 had this

(1) See B. Oct. 1914, No. 921. (Ed.)

dry character, the author thinks that it is not unprofitable to remind breeders of the affections to which their animals, especially young ones, are liable, and the precautions to be taken to avoid them. From the observations of GRANDEAU, BOUGARTZ, KEILNER, SEEL HORST, it is apparently proved that want of water for vegetation hinders the mineralisation of plants. When a deficiency is caused in a diet, the organism draws on its reserves. These being exhausted, it consumes its own substance and reduces its expenditure to a minimum. This faculty of saving and the importance of the reserves explain the irregularity in the periods of resistance. It is therefore not surprising that it should be in the spring and summer following the dry period that affections show themselves. To compound a ration we must know the useful substances, the foods which do not contain them sufficiently, the requirements of the organism for each and the form in which it is most suitable. The author proposes to take an inventory of the present knowledge on these questions.

**MINERAL ELEMENTS OF THE ANIMAL ORGANISM.** — Up to the present, the substances found in the organism are fairly numerous. We may suppose that, generally, the organism is well provided except with four of them: — Chlorine, sodium, calcium and phosphorus. It is easy to remedy the insufficiency of the first two. There remain the last two substances: — lime and phosphoric acid. KELLNER's experiments have shown that their assimilation attains the maximum when they exist nearly in the proportion suitable for the formation of a neutral salt. On the other hand WEISKE's researches have taught that compounds of phosphorus with an acid reaction can cause decalcification of the skeleton; apart from the addition of common salt, we have only to consider it in relation to animal nutrition. Very few foods have been studied regarding their mineral composition. It is therefore rather difficult to make an approximate account of the quantities of phosphoric acid and lime afforded by a ration. As a rule herbaceous fodder gives the lime. Grain and its derivatives provide more of the phosphoric acid.

**THE REQUIREMENTS OF THE ORGANISM.** — Researches to ascertain the daily requirements of the organism in mineral principles are very few and the results lack precision. To determine the requirements of an animal in lime and phosphoric acid it is not sufficient to establish the difference between the amounts consumed and those excreted. In the faeces are found materials which have played a part in vital processes. For herbivorous animals that is the principal exit of phosphoric acid and in all species, of lime, magnesia and iron. The urine, on the other hand, only contains phosphates which have been utilised by the organism. A certain proportion may have been assimilated during digestion and finding itself in excess in the blood, may be eliminated by the kidneys without having ever had to perform any function whatever. It is the over-supply which flows away. To determine the requirements of the organism, we cannot therefore have recourse to this method of balances. This opinion is confirmed by skilful experimentors such as LAVALARD, JOULIE, GRANDEAU, LEClerc and REGNARD. An exact determination, is not necessary and an

excess of tricalcic phosphate in feeding can do no harm. We may be guided regarding the requirements of growth by the figures obtained by LAWES and GILBERT and which were confirmed by the classic experiment of SOXHLET. However, deviations should occur in the proportion between the skeleton on one side and the fat, muscular masses and moisture on the other side, and according to age, feeding, race and the individual. To the elements determined by growth must be added those utilised for daily maintenance. We may obtain an indication of these in the quantities eliminated in the urine and foeces during a complete fast. But the fact that, in this case, the organism restricts its expenditure should be taken into account. Another factor which must be taken into account is the digestibility, and the influence exercised by the proportion one to another in which the various mineral elements are found in the ration and the predominance of acids over bases or vice-versa.

The author quotes some figures obtained with full grown oxen to ascertain their daily requirements in mineral elements. From their examination he concludes that it is not enough to consider the deficient element, but that the proportions between the various mineral substances should also be considered.

IN WHAT FORM SHOULD MINERAL SUPPLEMENT BE FURNISHED. — The direct assimilation of mineral phosphates was proved by FILLORY. From researches made by KOHLER, we may conclude that :— (1) the mineral phosphates have been assimilated ; (2) the assimilation of tricalcic phosphate has been greater than that of bicalcic phosphate ; (3) the phosphates of degelatined or calcined bones are shown to be decidedly less.

The author adds that bone meal may cause injury.

PRACTICAL CONCLUSIONS. — As a general rule, for herbivorous animals receiving in their rations a sufficient quantity of good herbaceous forage, there is no need to trouble to supply a mineral supplement. With hay of the dry period, or obtained from acid meadows, or when straw largely predominates in the ration, phosphate of lime may suitably be added. It should also be added to the ration of cows in milk or in calf when they get less than 5 kg. of good forage per day. With calves it will always be wise to give phosphate of lime from the time they are weaned, or even earlier if they are brought up on skim milk. Pigs are given foods poorest in mineral salts. The good effects noticed when they feed on clover, lucerne and green forage, are largely due to better mineral nutrition and also to the vitamines furnished by growing plants.

The requirements for maintenance in phosphoric acid and lime are approximately proportional to the live weight, and are the same for all domestic species.

Growth in the pig requires from 1 to 2 gm. of phosphates of lime per 100 gm. of acquired weight. Taking digestibility into account, a pig weighing 50 kg., gaining daily 600 gm. should get from 40 to 50 gm. of precipitated phosphate ; if this supplement is given in the form of bone meal the quantity should be doubled.

R. S.

843 - **The Stock Breeding Establishment at Sidi-Tabet, Tunis.** — GINTEIS, (Director of the breeding Establishment of Sidi-Tabet) in *Bulletin Mensuel de l'Office du Protectorat Français, Tunisie*, Year XIV, No 127, pp 161-164; No. 128, pp. 177-179; year XV, No 129, pp 1-4; No. 130, pp 17-19 Paris, Nov 1921-Feb 1922

The author recommends selection from the best Tunisian cattle and the improvement of these by crossing (1).

(a) *Continuous crossing* tends to substitution of the introduced breed and success depends on the quality of the imported breed. From the standpoint of the improvement of "mixed aptitudes", that is to say for the simultaneous development of meat and milk and draught animals, the Taranto breed is the first to deserve a trial. In case of non success, the Aubrac breed would perhaps be easily acclimatised

To obtain an animal specialised for the production of milk, two breeds possess notable qualities — the Breton and the Montbéliard breeds. Unfortunately their unpigmented parts predispose them to "amra". To avoid this the Bordeaux breed, whose black skin resists the harmful action of the sun, might be tried. At the same time the establishment will try to overcome the obstacles which paralyse the dairy industry in Tunis: — the unsatisfactory character of native labour, want of suitable buildings, severity of the climate, lack of transport

Crossing is of doubtful value for improvement of draught qualities. The Arab ox is such a good draught animal that selection would be sufficient. Crossing should be tried all the same, if only as a comparative method to give greater scope to the experiments and greater certainty to their conclusions. Only the Gascon breed of Ariège or of the Haute-Garonne, owing to its habitat in a warm climate, could be acclimatised in Tunis.

In the case of cattle intended for the slaughter house, improvement in beef qualities will come with other improvements

(b) *The industrial cross* produces cattle of high market value, but unsuitable for breeding purposes. It exercises no influence on the improvement of the breed. The Norman, and also the Dutch breed could be used for the production of milk, the Charolais, the Limousin or the Hereford breeds for the production of meat. The industrial crossing of the Arab cow with the zebu of India should alone be tried for the improvement of draught animals.

The selection and crossing of the indigenous breed will be supplemented by the maintenance of pure bred foreign stock. The results will be compared among themselves, and then with those obtained with the indigenous pure breed and with the various crosses.

Finally, alternative regular or irregular crossing followed by cross-breeding will not be neglected. Several questions suggest themselves — should animals with mixed or with special qualities be sought after? — if dairy farming appears to be the most remunerative, how will the milk be disposed of? — what is the yield of the different methods of fattening applied to various types of cattle? — for fattening calves, can

(1) See R. Jan. 1922, No 81. (Ed)

milk be replaced by substitutes? — in rearing, what is the cost price of the products of different ages? — when should they be sold?

All these questions can only be solved by experiment.

**EXECUTION OF THE PROGRAMME AND RESULTS OBTAINED.** — Such a large programme requires a number of years to accomplished. It has, however, been started and some animals of indigenous breed, some pure-bred zebus and some zebu-arab crosses have been studied and bred. Seven pure bred Arab cows have been bought. Their calves, by good feeding have developed remarkably and are better shaped than their parents. Varying between 10 and 15 kg. at birth, they weighed from 250 to 260 kg. when 18 months old. The bullocks bought from the dealers or in the country districts only weighed 220 to 250 kg. when 28 to 30 months old. This difference already proves how the native cattle can be improved by regular and abundant feeding. For want of a suitable Arab bull, the native cows were put to one of the zebu bulls and produced fine bull and heifer calves. The zebu-Arab cross would be an excellent animal for work were it not unmanageable and vicious. At the age of 24 or 30 months it is already a powerful worker, whereas the country ox does not become strong enough for draught purposes until about  $3\frac{1}{2}$  or 4 years.

The Establishment imported a bull and 2 Zebu cows from Ceylon and now possesses a herd of pure Zebu breed which includes 9 cows. With the object of avoiding too close inbreeding, another bull imported from India, has been used for breeding during the past two years. Most of the heifer calves have remained at Sidi-Tabet. In its new habitat the herd has not suffered any degeneration. In spite of his good shape the first bull gave defective calves. These defects were attributed to the bad influence of the climate, but as the second bull produced better calves, that cannot be the cause. The shape has been kept unaltered and the weight has not diminished, also the health of the herd is perfect, but the cows seem predisposed to abortion. The bulls rarely serve the cows under the age of 20 months or 2 years. Even when full grown and trained for service they will only serve cows which are well disposed to receive them.

**FUTURE PROGRAMME.** -- The purchase of one bull and 20 Arab cows will enable the selection of the race of the country to be undertaken. The purchase of bulls and cows of foreign breeds will render possible continuous crossing and the industrial crossing of the indigenous breed, as well as acclimatising experiments with imported animals.

**SHEEP.** - The sheep supplies 3 products: — meat, wool and milk. Meat is the dominant production; the wool at present has only a secondary importance. Nevertheless it will not be neglected, for its sale considerably increases the revenue of the Establishment.

In Tunis, sheep's milk forms a large part of the food of a considerable section of the population. Attention should be given to improving the milk yield of native cattle. To sum up, while giving the production of meat the chief place, the other products of the sheep should not be over-

looked. It is necessary to decide whether it is better to utilise special milch breeds or dual-purpose animals.

As in the case of cattle, the programme requires the examination of the two following problems: — 1) selection of the best animal, 2) study of the various requirements. To get the best animal two methods are suggested:— (a) the improvement of the native sheep; (b) the importation in mass of foreign flocks.

Whenever the race is worthy of it, the improvement of the native animal is the best method. It will influence every aspect of the case, and might then be followed up by selection and crossing.

In spite of its defects, the sheep of the country does not deserve to be condemned *a priori*. By judicious breeding with the best animals and sound methods of rearing of the lambs, better shaped sheep, heavier, producing more wool and more milk will be obtained.

But selection cannot be the exclusive method of improvement. It is incapable of transforming the thick tail into a thin tail. Innumerable observations have shown that by crossing a thick tailed sheep with a thin tailed sheep the thick tail disappears in the first generation. Owing to the short life of sheep, improvement should be obtained rapidly; this is impossible with selection, the results of which are very slow. Besides, crossing has not such serious drawbacks with sheep as with horses and cattle. Inbreeding will therefore be used for the ultimate improvement of the breed and industrial crossing for the rapid increase in profits. The experiments will bear, simultaneously, on both meat and milk producing races. For improvement of meat production Gran merinos, Berichon, Solognot, will be excellent improvers in extensive breeding. To suit the requirements of intensive breeding the Establishment will try:— Merinos of Soissons and of Châtillon, Southdowns, and Oxforddowns and Dishley Merinos. As regards milk-production three races deserve to be tried:— the Larzac, the Sardinian and the Bergamasque breeds.

The industrial crossing will be practised first of all with the breeds mentioned above and afterwards with still heavier races.

Although importation in mass of a foreign breed should only be an exceptional measure, a few breeds will be maintained under selection at Sidi-Tabet with several objects:— to compare first of all the whole of the indigenous selected animals, the half-breeds produced by the various crosses and the pure animals of the imported breeds; next, to ascertain the breeds which accomodate themselves best to the Tunisia and thus to determine the crosses to be recommended; lastly to provide the colony with rams.

**STUDY OF THE FACTORS.** — Regarding the production of meat, the fattening and sale of sucking lambs, of lambs of 7 to 10 months, of yearlings and of full grown sheep, from the standpoint of milk production, the descendants of the various races and of their cross-breeds will be compared, also the returns from the milk and its products. Is it better to produce the sucking lamb, sold when 3 or 4 weeks old, and then make use of the milk or to fatten the lamb up to the age of 3 to 4 months and not milk the

ewes until after weaning? Lastly in making use of the milk, what kind of cheese will be most profitable to produce? All these questions the Establishment will try to solve.

EXECUTION OF THE PROGRAMME. — Three breeds of sheep are at present being experimented with at Sidi-Tabet: —

- 1) Chatillon Merino,
- 2) Gran Morino improved by TRUELLE;
- 3) Barbary Solognot, established by Madame LAGRENÉE.

In 1917, 12 yearlings of from 16 to 18 months, and 5 yearlings belonging to the Chatillon Merino breed, were bought. Most of these sheep were well shaped and fulfilled the required conditions for an experiment of acclimatisation. Topping, gestation, lambing and weaning took place normally in 1918, 1919 and 1920. Topping commenced in June, lambing in November, weaning in March or April. While suckling, the ewes were fed with hay and grain; from weaning to lambing, they were run in the fields and on the stubble and in the evenings some green food or hay was given to them. The young animals always had hay and a ration of grain and with such a diet the animals were always in excellent condition. Up to the present they do not appear to suffer from the climate. The ewes imported from France have increased in weight and the lambs born in Tunis are as well shaped as their parents.

M. TRUELLE, a noted breeder in Tunis, has formed a fine flock of Gran Merinos and the Establishment bought a lot comprising 6 ewes and 1 ram from him. Since its introduction at Sidi-Tabet the Truelle Merino has prospered. All the animals bought are still in excellent health.

Madame LAGRENÉE had established a fine breed by crossing red legged Algerian ewes with a Solognot ram. Owing to its qualities the Solognot-Barbary cross is one of the most successful. From this flock, Sidi-Tabet purchased 6 yearlings and 1 ram, selected among the sheep which most resembled the Solognot. From all these experiments the following conclusions may be drawn: —

- 1) the possibility of acclimatising the 3 races tried;
- 2) the superiority of the Châtillon over the Truelle, and of the Truelle over the Solognot-Barbary, for good shape, development of the ribs and hind quarters, and richness of fleece;
- 3) the greater facility of lambing and more marked vitality of the lambs of the Solognot-Barbary than of the Gran Merino and specially than of the Châtillon, which seems most sensitive to inbreeding. In short, the Solognot-Barbary appears most likely to prosper on farms where the flock is sent to graze on distant land infested with amra; the Gran Merino is indicated rather in regions free from amra; the Châtillons will do well especially on farms where sheep are bred for the butcher. Lastly, if Tunis wishes to export frozen mutton to the French markets, the Châtillon breed is one which will obtain the greatest success in France.

Other domestic animals are not yet represented at Sidi-Tabet but

the programme of their improvement is worked out. It is the same as that which has been prepared for the horse, the ass, the ox and the sheep.

F. S.

814 - **Methods of Castration of Domestic Animals.** -- I. TREFFEL, Unblutige Kastration von Bullen, Schaf und Ziegenböcken mit der Burdizzozange, in *Berliner tierärztliche Wochenschrift*, Year XXXVIII, No. 11, pp. 121-123, figs. 3, bibliography of 14 publications. Berlin, March, 16 1922 -- II. SCHIEL, Ueber die Kastration der Haustiere, *Ibidem*, Year XXXVIII, No. 12, pp. 133-135, Berlin, March 23, 1922. -- III. BECKER, Fünfundzwanzig Jahre Kastration mit Sand'scher Zange und Emasculator, *Ibidem* year XXXVIII, No. 20, pp. 231-232. Berlin May 10, 1922.

I. NON-BLEEDING CASTRATION OF BULLS, GOATS AND RAMS WITH PINCERS OF THE BURDIZZO TYPE. -- The use of Burdizzo pincers (so called from the name of the Italian veterinary surgeon who patented them in 1910) is already, very wide spread in practice. The author, who began in 1920 to replace instruments of less recent date by these pincers, details the results obtained and the surgical technique which he has practised in the castration of numerous bulls, goats and rams.

II REGARDING THE CASTRATION OF DOMESTIC ANIMALS. This is a lecture which the writer gave before the Meeting of the Oldenburg Veterinary Association and the Meeting of the Association of Veterinaries of Eastern Prussia. The writer deals in an elementary manner with the different methods of castration of domestic animals, summing up the data of the experience which he has obtained from his long and extensive professional practice.

III. TWENTY FIVE YEARS USE OF THE SAND PINNERS AND THE EMASCULATOR IN THE CASTRATION OF DOMESTIC ANIMALS. The author has used the instruments indicated in the title of the article for 25 years and he has obtained excellent and constant results with them; he sets forth in detail the surgical technique adopted respectively for stallions, bulls, boars, goats, and rams, and makes some remarks on the preceding article by SCHIEL.

E. F.

#### HORSES

845 - **Survey of Horse-Breeding in Roumania.** -- STAVRILESCU, P. (Chief of the Veterinary Service of the Roumanian Army, Inspector General of the State breeding studs), in *Revue de Zootechnie*, No. 7, pp. 619-629. Paris, April 18, 1922.

Old chronicles, as well as accounts by travellers and representatives of the Great European Powers in the Danubian principalities, are agreed in recognising the superior qualities of Roumanian horses of the 16th and 19th centuries. Even in the pedigrees of the present famous Anglo-Norman horses of the *Nonius* family, there is found at the source in the tenth generation a *Moldavian mare*. The reputation of the Moldavian breed lasted up to the middle of the 19th century. The writer then gives the characteristics of Moldavian and Wallachian horses and of the horses of Dobrudja. The decay of the Roumanian horses dates from 1775, when the Treaty of Adrianople opened the Roumanian ports, and so enabled the wheat of the Danubian principalities to be exported. England offered good prices for Roumanian cereals, the vast grass plains were transformed



into granaries and breeding was neglected. With the introduction of agricultural machinery in 1840 the horses lost their last important work, that of threshing wheat. At the same time after 1785 Austria and Germany became self-sufficing as regards their requirements in horses and Hungary became the chief breeding ground for Europe and supplied horses even to France. Roumanian horses were no longer valued and a complete decay of the race set in. In reality the horses of the ancient Roumanian Kingdom were, and are still today, a mixed breed of ponies varying in height between 1.45 m. and 1.25 m. mostly with short and straight lines. In Moldavia, the Syrian type dominates, next the Persian, the Barb, and the Tartar; in Wallachia, the preceding and the ancient Magyar; in Dobrudja, the Turkish and Barb types and with these the Danish, Percheron and Russian Ardennes types are bred. Owing to lack of care and selection and being in worse conditions than in a wild state, the Roumanian horses have perpetuated themselves during the whole of the 19th century with a tendency to reversion to the wild type, the more so as the best of them were sold while the poorer specimens of the race were kept for breeding. This decay in the breeds of horse was produced as a consequence of the international economic fluctuations leading to all kinds of change. The double agricultural and social evolution of modern Roumania was coincident with rapid progress in animal production in neighbouring countries. Roumania had not the means of correlating her various productive activities, and devoted all her attention to the growth of cereals and learnt too late that Hungary was importing Roumanian wheat, milling and selling it to foreign countries under the Hungarian label and in exchange, in concert with Russia, was sending Roumania her cheap modernised horses. To remedy the bad conditions with regard to horsebreeding a national stock of mares was established in 1864, in 1908, it passed to the charge of the Ministry of Agriculture by whom it was entrusted to veterinary surgeons, who boycotted the English thoroughbred race. However some Arabs and Anglo-Arabs were bought in the south of France, as well as some stout half-bred horses. Of these there were about 350 when the war broke out.

During the war Roumania placed her stallions in Podolia, and not one of them returned. The mares of the country were, during the German occupation evacuated into Germany and to the French front. Thus Roumania found herself practically without horses in 1918. But Bessarabia still possessed a fairly good number of mares, and Transylvania and the Banat had kept during the war several thousand mares of half-bred Arab, half-bred English, Anglo-Norman, Naric, English thoroughbred and American trotter types and as stallions, 200-300 half-bred English and Anglo-Norman. Such was the situation of horsebreeding in *New Roumania* at the Treaty of Versailles.

The offensive of the Hungarian army against Roumania, in 1919, gave Roumania facilities for improving its position for horse breeding as the mounts and teams of the Hungarian prisoner army became Roumanian and mares were bought in occupied Hungarian territory. The number was increased by 800 Hungarian national stallions from depôts in Transylvania

and the Banat or from those captured. Almost all the stallions of the Royal Hungarian Stud of Mezo Hegyes became war booty and were added to the total. With all these elements it has been possible to create the following national horse breeding institutions:— *Military studs* — at Comischani, Ciolan, Zilistea, Jigalia, Hamanzi; *Civil Studs* at Valassont-Boutzida, Fagaras, Partza and Radaoutzi; *Stallion depots* at Constanza, Slobozia, Grasci, Radaoutzi, Homorod and Tournou-Severn.

As large estates have ceased to exist in Roumania since 1917, and the 5 hectares sold to each peasant not being suitable for horse breeding, measures have been taken to establish a national horsebreeding estate of 12 500 hectares to be handed over in lots of 250 hectares to breeders able to produce stallions intended for the improvement of the horses of the peasants.

F. S.

846 - **Observations on Twin Gestation in Mares.** - REISEL, A. in *Berliner Tierärztliche Wochenschrift*, Year XXXVIII, No. 3, pp. 28-29. Berlin Jan. 19, 1922.

The author states that mares do not generally reach the end of the period of gestation when carrying twins, but that they abort or that the foals which they bear do not live. In confirmation of his statement he quotes three very convincing cases which he observed in 1921. In the light of these cases it may be considered probable that mares carrying twins, if they abort one, can complete the gestation process to the end and give normal birth to the second.

The practical importance of these observations is very considerable for the numerous class of breeders which makes a practice of insuring their mares in foal and their foals: in a case of twin gestation, it may well happen that either abortion is limited to one of the twins and then the breeder, who will have the other twin healthy and normal, has no right to the whole of the insurance benefit, or else that the insurance company considers itself free of risk when an abortion takes place, whereas in reality the breeder must still take the risks of the birth of the other twin. The veterinary surgeon should refrain from ordering or even recommending the washing of the uterus after an abortion, as in such a case this treatment may cause the abortion of the second foetus.

It is possible in the absence of other symptoms to recognise the death of one or of both the unborn twins, when it is known that the teats of the mare in foal swell and begin to function, as is the case physiologically at the end of the period of gestation.

E. F.

847 - **Limits of the Breeding Age in Thoroughbred Mares.** - WOOD, in *Annales de Médecine Vétérinaire*, Year 67, No. 6, pp. 269-270. Ixelles-Brussels, June 1922.

In order to ascertain the age at which a thoroughbred mare ceases to reproduce, the author who is a member of the Cambridge School of Agriculture consulted the first volume of the General Stud Book, which covers a period of about one hundred years.

Out of 1216 mares for which the dates of birth and of last foaling are exactly recorded, 709 (58.3 %) reproduced at the age of 18 years; 648 (53.05 %) at 19 years; 548 (45.07 %) at 20 years; 457 (37.58 %)

at 21 years; 333 (27.38 %) at 22 years; 248 (19.01 %) at 23 years; 146 (12.01 %) at 24 years; 85 (7 %) at 25 years; 37 (3.06 %) at 26 years; 17 (1.42 %) at 27 years; 7 (0.61 %) at 28 years; 4 (0.27 %) at 29 years; 2 (0.11 %) at 30 years. One mare is recorded as having given birth to a foal at the age of 33 years.

From the above figures it would appear that the reproductive capacity of the mare lasts all her life. The fact that life does not last longer than the period of fertility is undoubtedly due to the state of the teeth, the wearing out of which generally precedes the functional rest of the ovary. For this reason it is practically impossible to fix the epoch of the menopause for the mare.

The author has been able also to ascertain that in a total of 80 stallions death has taken place at the average age of 22.7 years. F. D.

848 - **The Stock of Cattle in Morocco.** LERAY, A. M. in *Revue de Zootechnie*, No. 6, pp. 512-523. Paris, March 15, 1922 (1).

CATTLE

The strength of the Moroccan herds has doubled in the space of 6 years. This remarkable development is largely due to the prohibition of the slaughter of females of less than 8 years old and of bull-calves with less than 4 second teeth.

It is to the relative humidity of its winter climate and to its numerous streams, which do not dry up in summer as do the Algerian and Tunisian "oueds", rather than to the physical and chemical properties of its soils, that Morocco appears to owe its special adaptation for the production of cattle. It has been ascertained that there is in Morocco 1 head of cattle per 15  $\frac{1}{2}$  hectare. In Algeria the proportion is 1 for 50 hectares; in Tunis it is 1 for 26  $\frac{1}{2}$  hectares.

The stock of cattle in Morocco is not homogeneous. In the herds belonging to the native are constantly found individuals which, by their external characters, appear to have resulted from the union of three fundamental types, which the author describes. Generally, it is very difficult to succeed in isolating in the herds an individual which possesses exclusively all the characters of one of these types. However, it would be easy by patient selection to constitute in Morocco three distinct races of cattle. This work is partially realised at Meknès. The author describes this animal and concludes that it resembles all country bred cattle which have not yet benefited from the improving effect of the procedure employed by large breeders. The European colonists, who replace the rough native methods by more scientific agricultural working, obtain better animals, but the data collected are still too few to allow the determination by means of precise figures of the degree of advance in development.

**APTITUDE FOR THE PRODUCTION OF MEAT.** — The cattle of Morocco are subjected, according to the season, to alternate abundance and scarcity of food. The yield of dressed meat of the animals slaughtered, reaches a maximum from May to July and a minimum from November to January.

(1) See *R.* June 1914, No. 544. *R. Sept.* 1917, No. 1253 — *R.* Feb. 1919, No. 226 — *R.* April 1919, No. 413. (Ed.)

and the quality of the meat varies also during the same periods. In spring Moroccan butchers meat compares favourably with that of French feeding, whereas, from September it tends to become tough and stringy. On the average the weight of the 4 quarters is as much as 40 to 55 % of the live weight in Moroccan cattle. The hide of a full grown animal weighs about 30 kg.

**DRAUGHT QUALITIES.** — The natives employ draught oxen almost exclusively for ploughing and require at least 100 000 oxen for agricultural work. With the object of determining the capacity for work of these animals, dynamometric tests have been made according to RINGELMANN'S method. According to the results obtained at Casablanca, the average effort of a Moroccan ox appears to be about 35 kg. This fact requires to be taken into consideration, for it is connected with the problem of the improvement of native methods of cultivation.

**MILK-PRODUCTION (I).** — The author notes the importance of milk production for supplying the towns, the success of milk and butter competitions at Meknès, and the results of comparing the milk record, of cows belonging to a native dairyman of Salé on one hand with those of 31 cows bought in the country and rationally fed on the other hand. These results lead one to conclude that it would be possible to constitute in Morocco herds of indigenous cows giving per head, on an average, in a period of lactation of 10 months, from 1800 to 2000 litres of milk. To effect this it would be sufficient at the outset to form a herd by careful selection, preferably from the black-piebald Meknès breed.

#### 849 - The Importation of Tropical Cattle into the Northern Territory of Australia.

I. Brahmin Cattle for the Tropics, *The Pastoral Review*, Vol XXXI, No. 9, pp. 687, Melbourne, September 1921 — II. W. DAVISON, (Live Stock Expert, Department of Agriculture, Mysore State, India), (Tropical Cattle for the Northern Territory), Notes on Indian Breeds, *Ibid*, Vol. XXXI, No. 12, p. 603, Fig. 1, Melbourne, December 1921.

I. — It is considered advisable that the *Brahmin* breed of cattle should be imported into the Northern Territory of Australia. This breed has been introduced into the South-eastern districts of the United States and has given excellent results; the animals are resistant to parasitic insects and their quality is transmitted to the descendants even when the blood-relationship is only  $\frac{1}{16}$ . The hump, which is characteristic of the breed disappears almost entirely in the half-breeds, in general appearance the animals give the impression of possessing great vitality. They develop well and mature at an early age.

The bulls exceed 17 cwt. in weight.

II. — DAVISON denies the accuracy of some of the above statements; in the first place the name *Brahmin* is misleading and is used in Texas to include all cattle of the species *Bos indicus*. Actually, the term *Brahmin* is applied to bulls of any breed which have been dedicated to a temple or deity. Moreover, these cattle are not immune from ticks which are found in thousands on every animal. There is certainly a marked resistance to

(1) See R. Sept. 1920, No. 893. (*Ibid*)

piroplasmosis, but this resistance is very much weakened in the first cross with European breeds.

DAVIDSON does not agree that the stock mature at an early age; bulls are not fit for service until they are more than two years old, and heifers rarely have their first calf before the fourth year.

As a matter of fact, this slow maturity adds to the cost of production and hinders cattle-breeding in India. Experiments which were recently carried out by the Mysore Department of Agriculture to compare the food value of different rations for half-bred calves, the results of crossing a pure-bred Ayrshire bull with Sindi cows, and pure bred Sindi calves give very convincing results.

The total body-weight increase for the experimental period was 75.5 % in the case of the half-breds, and 43 % for the Sindi calves. It is worthy of note also that the half-breds matured much earlier than the native breed.

The author agrees that some Indian breeds, but not all, are much more resistant to certain epidemic diseases than are cattle from temperate zones. Their export has been chiefly to Texas and the States bordering on the Gulf of Mexico, and also to Jamaica, South America and Java. E. F.

- 850 **Studies on Beef Production.** -- I. HAECKER, T. I., *Investigations in Beef Production, The University of Minnesota Agricultural Experiment Station, Bulletin 103*, 110 p., figs. 11, University Farm, St. Paul, 1921. -- II. POTTER E. L. and WILHYCOMBE, R., *Raising Steers, One on Agricultural College Experiment Station, Station Bulletin No. 182*, 15 pp. Corvallis, Oregon, Sept. 1921. -- III. BLACK, W. H., *Beef Production in the Corn Belt, Farmers' Bulletin 1218, U. S. Department of Agriculture*, 34 pp., figs. 11, Washington, Nov. 1921. -- IV. MC CAMPBELL, C. W., and WINCHESTER, H. B., *Cattle Feeding Investigations 1920-21, Agricultural Experiment Station, Kansas State Agricultural College, Manhattan, Circular 92*, 13 pp., Topeka, 1921. -- V. MUMFORD, F. B., HOGAN, A. G. and SALMON, W. D., *Influence of the Plane of Nutrition on the Maintenance Requirement of Cattle, Journal of Agricultural Research*, Vol. XXII, No. 3, pp. 115-121, Washington, Oct. 15, 1921. -- VI. LEROY, A. M., *Signification physiologique de l'etat des dépenses de la croissance chez les bovidés, formulée par MM. Goutin et Andouard Comptes rendus de l'Académie d'Agriculture de France*, Vol. VI II, No. 10, pp. 501-507, Paris, May 11, 1922.

I. -- STUDIES ON BEEF PRODUCTION. -- T. L. HAECKER'S work is divided into 3 parts: 1) the composition of steers during the different periods of growth and fattening; 2) the relation between the consumption of nutritive units and the accumulation of substances in the organism during the different periods of growth and fattening; 3) the need of digestible nutritive substances for the production of beef.

He makes a study of the composition of steers from their birth until they are slaughtered, dividing the time into successive periods of 100 lb. increase of live weight. The study is based on the chemical analyses of the different parts of the body of 63 animals, and on the record of the food consumed by 189 animals. The analytic data are given in 54 Tables, and the methods of analysis employed are described in an appendix.

Table I gives some of the most important results recorded in the two first parts of the work. The term "total tissue" at the top of the 2nd

column signifies the body weight minus the weight of the digestive organs.

TABLE I. — *Body constituents of steer at different weights, and composition of increases in weight of tissues.*

Live weight in pounds	Body constituents of steer in pounds					Percentage composition of increase in weight of tissues			
	Total tissues	Water	Protein	Fat	Ash	Water	Protein	Fat	Ash
						%	%	%	%
100	84.85	60.94	18.88	3.41	3.62	71.84	19.89	4.00	4.26
200	157.91	111.23	30.24	9.45	6.99	68.83	18.29	8.27	4.61
400	326.60	214.83	63.08	34.63	14.16	61.42	19.46	14.87	4.25
600	487.05	298.05	94.51	73.30	21.19	51.87	19.58	24.17	4.38
800	679.12	398.78	127.72	125.82	28.80	51.40	17.30	27.34	3.96
1000	873.57	454.30	140.29	235.40	34.58	29.58	11.10	56.35	2.97
1200	1085.84	530.55	173.91	351.26	40.12	31.21	11.61	54.58	2.60
1500	1344.90	534.74	211.45	505.60	43.11	24.78	14.49	59.58	1.15

A gradual increase of the capacity of the animals' gastro-intestinal capacity kept pace with the increase in the live-weight.

In the case of steers slaughtered when they had attained the same live-weight, there were greater dressing losses in the animals kept at grass, than in the stall fed animals.

In passing from 45 to 545 kg. of live weight, the increased live-weight of the total tissues was 91 kg.; this was made up of 41.78 kg. of water and 49.22 kg. of dry matter containing 14.28 kg. of protein, 31.62 kg. of fat and 3.32 kg. of ash. The dry matter in the total tissues rose gradually from 28.16 % (live-weight of 45 kg.) to 52.23 % (live weight of 500 kg.). Between 500 and 600 kg. the organism undergoes no essential change in its composition.

It contains 19 %, or more, protein up to a live weight of 318 kg. The protein subsequently diminishes gradually until it amounts to 16.02 % (live weight of 545 kg.) and to 15.72 % (live weight of 681 kg.).

The fat increases from 10.5 to 18.5 % between 182 and 363 kg. of live weight, and from 18.5 to 32.0 % between 363 and 500 kg. Later, the percentage only varies slightly. The amount of ash is very constant viz., 4 % or more between 45 and 409 kg. and 3 %, or more subsequently.

The bones contain a considerable amount of protein and fat. When boiled 4.5 % of the protein, 28.5 % of the fat and 1.07 % of the ash pass into the broth.

The edible part of the quarters is 50 % of the weight in the case of animals weighing 45 kg. and 59 % and 72 % respectively for those of 272 kg. and 545 kg. respectively of the total organic substances (fat  $\times$  2.25 + protein), the eatable percentages are : 50.6 at 45 kg. of live weight ; 66.4 % in animals 2 years of age and 86.6 % when the weight live is 545 kg.

These data show how important it is from the point of view of economic production not to slaughter any but mature animals.

As regards the constituents fixed during the increase in live weight, the following may be noticed among the many mentioned by the author:

There was little change in the amount of water fixed in the tissues for every successive increase of 45 kg.

The animals slaughtered after reaching the weight of 227 kg. or less, had fixed in their tissues 28% of the crude digestible protein ingested; those slaughtered when they weighed between 272 and 363 kg. had assimilated 24.4 % of this protein, and animals sent to the abattoir when they weighed from 408 to 680 kg. had assimilated 20.4 %.

The amount of food (digestible fat  $\times$  2.25 + digestible protein + digestible carbohydrates), consumed to produce 1 kg. increase in live weight was 8.2 kg. for weights from 45 to 363 kg., 6.6 kg. for those between 45 and 681 kg. which confirms the advantage of slaughtering mature animals. The percentage of protein fixed in the tissues was 13.35 of the digestible ingested protein in the case of steers slaughtered when weighing 45 kg., 14.58 in that of steers weighing 136 when slaughtered, and 15.53 — 14.7 — 14.20 respectively when the animals weighed 363 — 454 — 617 kg.

There was a gradual increase in the fixing of fatty substances, 6.06 % between 45 and 901 kg.; 17.34% when the animals weighed 363, 24.35 — 31.28 % when they weighed between 409 and 545 kg., and 36.21 % when their weight was 681 kg.

The amount of ash fixed rose from 3.36 to 3.73 % between 90 and 318 kg., and fell slowly afterwards to 2.8 % at 681 kg.

The total organic products fixed increased slowly from 26.99 % (at 90 kg.) to 85.22 % (at 545 kg.).

It is possible to distinguish a growth period up to 363 kg. and a fattening period after 363 kg. During the first period, more protein is assimilated than fat, during the second, the opposite is the case.

In the third part of his work, the author gives the feeding plans for beef cattle. He bases his remarks on the results of eight years' research and fixes the maintenance ration at 0.4 kg. of crude digestible protein per 100 kg. of protein contained in the organism and allows 1.75 kg. of crude protein to be fixed by the organism. The total necessary food is determined from the protein requirements assuming that the nutritive ratio should be gradually extended, until the animals weigh 409 kg., and from that time should remain 1 : 10.

Assuming grains to mean not only grain, but its by-products (bran, shorts, cakes), and bulky forage to include hay and silage, and increasing by 10 % the amounts actually used in the experiments, in order to better agree with the conditions of practical stock-feeding which cannot be so systematically regulated as in an experiment, the author advises feeding the following quantities in kg. for every 100 kg. of live weight: at 60 kg. 0.7 grains + 0.7 bulky forage; at 91 kg.: 0.9 + 1.3; at 136 kg. 1.1 + 1.7; at 182 kg.: 1.1 + 1.8; at 227 kg.: 1.1 + 1.7 at 250-318 kg.: 1.0 + 1.6; at 363 kg.: 1.0 + 1.7; at 409 kg.

1.0 + 1.6; at 454 kg. 1.0 + 1.4; at 500 kg. : 1.0 + 1.3; at 545 kg. : 1.0 + 1.1 per head and per day.

II. — WINTERING OF STEERS. — Report of 3 different experiments lasting two years in which bulky forage was fed to wintering cattle.

The calves were bought in the autumn and kept when they were given no concentrates, until the end of the second grazing summer.

As a basis for the comparison of other foods a whole ration of lucerne hay was taken (on an average 9 kg. for calves, and 11.8 kg. for steers above one year of age). Straw with the addition of a little silaged forage (4.5 kg. the first winter and 6.8 kg. the second), or a little cottonseed cake (0.9 kg.) produced slow, but satisfactory increases in live weight.

In the first experiment, a lot fed straw and cake attained the same live weight by the time they were sold for the abattoir as the lot fed inferior lucerne hay the first winter and good lucerne hay the second. In the third experiment, one group fed exclusively a full ration of silaged forages (14.5 kg. given to the calves and 21.3 kg. to the steers) increased considerably in live weight during the winter, but their final live weight per head was only 539 kg. as against 594 kg. for the group fed the same ration of silage + 0.9 kg. cottonseed cake. In the same experiment animals that had wintered on lucerne hay alone only attained an average live weight of 563 kg., whereas the others fed a little silage in addition weighed 577 kg.

In all these experiments, one or two groups received during the winter some barley with the lucerne hay, or else barley + lucerne hay + silaged forages, and were sold at the end of the second winter. The live weights attained were not always satisfactory.

The thinnest animals at the end of the winter increased most in weight during the summer grazing, thus regaining 55 % of the difference between their weight and that of the cattle that had been well fed throughout the winter.

From these results the following conclusions may be drawn.

The way in which cattle are wintered does not merely determine the increase in live weight during the winter, but has a great influence also upon the live weight attained during the grazing season, as well as upon the age at which they are ready for the butcher and their final weight and quality. Cattle kept on scanty rations during their first and second winters were not as heavy when slaughtered as the animals that had been liberally fed during that time. On the other hand, the cattle that had grown least during the winter rapidly increased in size during the summer grazing season, while those that had developed most during the winter, lost about half this advantage by increasing little in size when turned out to grass in the summer.

Steers should be kept in good condition during the winter, but large increases in live weight at that season are not necessary or even desirable, unless they can be attained at small cost.

The increase of live weight obtained at grass is always cheaper than that produced by winter feeding, thus the steers should be kept at grass



as long as possible. If early maturing calves are reared, it is well to feed concentrates during the winter, they should not, however, be given to cattle that are to remain at grass during the summer. Where abundant pasturage is available, the rearing of young, early steers fit for the butcher before they are 2 years old pays much better than breeding animals to be slaughtered at the age of 2 or 3 years.

III. — BREEDING BEEF CATTLE IN THE MAIZE ZONE OF THE UNITED STATES (1). — This Bulletin which has been enlarged and brought up to date has been substituted for the Farmers' Bulletin 588 "Economical Cattle Feeding in the Corn Belt" and gives rules for rearing, buying and fattening beef cattle in the maize zone of the United States where the pastures are gradually disappearing and being ploughed up. A summary is given of the results of experiments made at the Experiment Stations of North America, the rations based in this work are recommended, and some of the numerous data collected as a result of an enquiry as to the fattening methods adopted in Indiana, Illinois, Nebraska and Missouri are set out in Tables II and III.

In the general average calculated for the whole maize belt, the average amounts of food consumed by one cow during the winter (5½ months) are as follows: grains 55 kg. + hay 86½ kg. + silaged forage 318 + straw 300 kg. + maize fodder 4.8 ares + maize stalks 65 ares + maize stover 9.7 ares + 4 days winter grazing

*Rations advised for wintering a herd of breeding cattle*

Rations with silaged forages.

1) Silaged forages 13.6 kg. + straw 4.5 kg. + cottonseed cake or linseed cake, 0.5 kg.

2) Silaged forages 11.4 kg. + clover hay, or lucerne hay, 4.5 kg.

3) Silaged forages 16 kg. + mixed hay 4.5 kg. + cotton, or linseed, cake 0.2½ kg.

Rations without silaged forages:

4) Maize-fodder 6.8 kg. + oat straw 4.5 kg. + cottonseed, or linseed cake 0.5 kg.

5) Clover, or lucerne, hay 9 kg. + straw or maize stalks 2.3 kg.

6) Mixed hay 4.5 kg. + mixture of equal parts of maize, bran and oats 2.3 kg. + straw, or maize stalks 4.5 kg.

Wintering rations for thin cattle:

1) Silaged forages 6.7 kg. + clover, or lucerne, hay 1.8 kg.

2) Silaged forages 6.8 kg. + cottonseed, or linseed, cake 0.23 kg. + straw, or maize stalks, 2.3 kg.

3) Clover, or lucerne, hay 4.5 kg. + straw, or maize stalks 2.3 kg.

4) Mixed hay + straw, or maize stalks + cottonseed, or linseed, cake 0.5 kg.

These rations are suitable for one-year-old animals; and must be increased by about one half when the cattle enter upon their second year.

(1) See R. March 1919, No. 33. (Ed.)

*Rations for fattening two-year-old steers (in kg. per 1000 kg. of live weight).*

- 1) Silaged forages 40 + maize 6 + cottonseed, or linseed, cake 3 + straw, or maize stalks, 5; nutritive ratio 1:7.5.
- 2) Silaged forages 40 + maize 10 + cottonseed, or linseed, cake 2 + lucerne, or clover, hay 2; nutritive ratio 1:7.3.
- 3) Silaged forages 30 + maize 15 + cottonseed, or linseed, cake 2 + straw or maize stalks, 4; nutritive ratio 1:9.
- 4) Silaged forages 20 + maize 18 + lucerne, or clover 6; nutritive ratio 1:8.7.
- 5) Silaged forages 40 + maize 15 + linseed, or cottonseed, cake 2.5 + straw, or maize stalks, 4; nutritive ratio 1:8.1.
- 6) Silaged forages 30 + maize 10 + cottonseed, or linseed, cake 3 + molasses 2 + straw, or maize stalks 5; nutritive ratio 1:8.
- 7) Maize 10 + cottonseed, or linseed, cake 4 + mixed hay 10 + straw, or maize stalks, 5; nutritive ratio 1:5.8.
- 8) Maize 10 + cottonseed cake 2 + lucerne or clover hay 5 + straw, or maize stalks, 10; nutritive ratio 1:7.
- 9) Maize 16 + cottonseed, or linseed cake, 2.5 + clover, or timothy, hay 10; nutritive ratio 1:6.8.
- 10) Maize 20 + lucerne, or clover, hay 10; nutritive ratio 1:7.2.
- 11) Maize 15 + cottonseed, or linseed, cake 3 + straw 5 + maize stalks 10; nutritive ratio 1:7.8.
- 12) Maize 15 + cottonseed, or linseed, cake 2 + molasses 2 + legume hay 4, nutritive ratio 1:7.3.

TABLE II. — *Food consumed per head and per 100 kg. Increase in live weight in the maize belt, United States.*

Initial weight per head . . . . .	357 kg
Average final weight per head . . . . .	486 "
Increase per head . . . . .	129 "
Length of fattening period. . . . .	174 days

*Total food consumed per head:*

Grains . . . . .	877 kg
Commercial concentrates . . . . .	79 "
Dry bulky forage . . . . .	504 "
Silaged forage . . . . .	1113 "
Grazing . . . . .	55 days

*Total food consumed per 100 kg. increase in live weight:*

Grains . . . . .	680 kg
Commercial concentrates. . . . .	62 "
Dry bulky forage. . . . .	391 "
Silaged forage . . . . .	863 "
Grazing . . . . .	20 days

TABLE III. — *Method advised for fattening two-year-old steers at grass with supplementary rations.*

Methods	Length of grazing period days	Supplementary food per head and per day
Grass only . . . . .	150	
Grass + maize . . . . .	210	Maize 4.5 kg. to 5.4 kg.
Grass + cotton seed cake . . . . .	210	Cake 1.1 kg. to 1.8 kg.
Grass + maize + cotton seed, or linseed, cake . . . . .	210	Maize 3.6 kg. to 4.5 kg. + cottonseed, or linseed cake 0.5 kg. to 0.9 kg.
Grass for 210 days followed by maize for the last 90 days. . . . .	210	Maize 5.4 kg. to 6.8 kg.
Grass for 210 days followed by maize + cottonseed, or linseed, cake for the last 90 days . . . . .	210	Maize 4.5 kg. to 5.4 kg. + cottonseed, or linseed, cake 0.7 kg. to 1.1 kg.

IV. — CATTLE FEEDING INVESTIGATIONS. — This Circular gives a very good account of the results obtained by 5 different experiments.

During the first experiment of which the object was the maximum economical utilisation of silage in fattening baby beef, lasted 207 days. Two different rations were fed, one containing much silaged forage and a small quantity of grains, and the other little silaged forage and a large amount of grains. Lots 3 — 4 — 5 — 6 (each of 10 head) consumed respectively an average daily ration per head of 3.4 — 9.3 — 5.3 — 6.2 kg. of cane silage; the 5th lot received in addition 0.8 kg. molasses per head and per day. Lots 3 and 4 were fed no maize during the first 120 days of the experiment. The addition of 0.9 kg. of lucerne hay per head daily increased the gains of lots 3 and 5 132 gms. a day, reduced the cost of live weight gain 55 cents per 100 and added 50 cents per 100 to the selling price of the steers in lot 3. The addition of molasses increased the daily gain in live weight and improved the general appearance of the calves in lot 5, but also increased the cost of the gains and apparently reduced the selling price compared to lot 4.

In the second experiment, ordinary mature steers were fattened versus good quality mature steers for 178 days; both lots were given the same ration, cane silage + lucerne hay + cottonseed meal + shelled maize.

The ordinary cattle were big, rough, coarse, plain-headed animals uneven in size and conformation. The good quality cattle were smooth, well made steers with good heads, even in size and conformation. The daily gains were practically the same in both lots, but the quality steers required slightly less feed to produce 50 kg. gain and showed a slightly higher dressing percentage.

The results of this experiment do not indicate that scrub cattle should

be produced, but show that the big, heavy-boned, broad-backed individual makes the greatest and most economical gains, whereas the small fine-boned, tidy animal makes a good-looking fat steer but is expensive and does not fetch a sufficiently high price to compensate for the extra cost.

In the third experiment, the rival merits of silage versus lucerne hay for the development of stock cattle were compared. It was found that steers over 2 years of age if wintered on silage made very satisfactory gains when placed on pasture the following summer.

The fourth experiment deals with the relative feeding value of different kinds of maize silage viz., 1) maize harvested and silaged when in dent stage of maturity; 2) maize cut and silaged 6 weeks later when quite ripe; 3) maize stover cut at the same time as 2.

The maize cut in the dent stage produced 9.47 tons of silage per acre, of which 2.89 tons were dry matter, whereas the maize cut when fully mature, only produced 4.47 tons of silage of which 1.88 tons were dry matter.

These results show that silage made from maize cut in the dent stage has considerably more feed value per acre than maize cut when fully mature, one acre in the dent stage producing 330 kg. gain compared to 200 kg. gain per acre from silage made of maize cut in the fully mature stage.

The fifth experiment was made to determine the relative feeding value of the grain of fully mature maize in silage and the grain of maize that has been husked, shelled, and fed dry. The test indicates that silage from mature maize has a greater feeding value (12% higher), as shown by gains in live weight than shelled maize grain.

V. -- CONNECTION BETWEEN THE AMOUNT OF THE RATION AND THE MAINTENANCE REQUIREMENTS OF CATTLE (1) MESSRS. MUMFORD, HOGAN and SALMON have determined the amount of net energy required for maintenance, basing their estimate on the food consumed and gains made by 10 steers used in the experiments carried out at the Missouri Agricultural Experiment Station.

The animals used in the experiment were divided, while still calves, into three lots, each being kept on a different plane of nutrition. Lot 1 was able to grow rapidly, but did not fatten; lot 2 fed less than lot 1 gained about 225 gm. per head and per day, while lot 3 which received still less food, only gained about 150 gm. per head and per day.

The concentrates fed were whole maize meal, wheat bran and linseed cake (6 : 3 : 1); the bulky forage being usually lucerne hay and straw (3 : 3); a little milk was also given to the calves.

The maintenance requirements were determined during the summer in successive periods usually lasting 180 days. The energy gain and loss due to alterations in weight were reckoned from the data summarised in Table IV.

(1) See R. Mar. 1922, No. 280. (Ed.)

TABLE IV. — *Net energy required for maintenance by the cattle and transformed into live weight.*

Lot	Increase in weight	Energy required for 1 kg. increase in live weight at different ages (in thousandths of calories)						Energy consumed daily for mainte- nance per 1000 kg. of live weight (in thousandths of Calories *)	
		at 6 months	at 18 months	at 36 months	at 54 months	at 66 months	at 78 months	Determined by dry matter method	Determined by Armsby-Fries method
1	Rapid without fatten- ing . . . . .	2.112	2.413	3.879	4.860	5.525	6.63	12.206	12.709
2	About 225 gm. per day	2.112	2.338	2.566	3.116	3.392	3.89	9.912	10.760
3	About 150 gm. per day	1.843	2.086	2.333	2.433	3.269	3.65	8.464	9.742

The maintenance energy required was calculated in two ways: 1) from the consumption of dry matter; 2) from the consumption of digestible organic matter (ARMSBY-FRIES) method (1); the authors consider the latter slightly the more exact.

The digestion coefficients used were taken from the results of the digestion experiments carried out at the Missouri Experiment Station, and the amount of energy necessary for the maintenance of each 1000 kg. of live-weight was calculated on the assumption of its being  $\frac{5}{8}$  of the live weight, according to the results obtained by MOULTON (2).

The data summarised in Table IV show the strict connection between the amount of net energy consumed and the maintenance requirements. Taking at 100 the amount of energy consumed by lot 1 per 1000 kg. of live weight, the net energy consumed is 84.4 % in lot 2, and 76.3 % in lot 3, if calculated according to the ARMSBY-FRIES method, and 81 and 69.3 % if estimated from the quantity of dry matter ingested.

There appears to be no connection between the age of the animal and the amount of energy required for its maintenance.

VI. — THE PHYSIOLOGICAL SIGNIFICANCE OF THE LAW OF GROWTH COST AS FORMULATED FOR CATTLE BY MESSRS. GOUIN AND ANDOUARD. GOUIN and ANDOUARD's law is based on the hypothetical existence of a connection between the growth cost on the one hand, and the daily increase

(1) ARMSBY, H. P. and FRIES, J. A. Net Energy Values for Ruminants, *Pennsylvania Agricultural Experiment Station Bulletin*, 141, 1916; summarised in *R.* March 1917, No. 258.

(2) MOULTON, C. R., The Availability of the Energy of Food for Growth, *Journal of Biological Chemistry*, Vol. 31, No. 2, pp. 389-394; summarised in *R.* April 1918, No. 441. (Ed.)

in live weight of the animal on the other; this correlation is supposed to be independent of the age of the animal.

Of the two portions making up the ration of an animal which is not yet adult, the *maintenance ration* is clearly proportionate to the surface  $S$  of the individual (being connected with the weight  $P$  by a relation in the form of  $S = K \times P^{2/3}$ ); the *production or growth ration* depends on the daily gain  $g$  and the weight  $P$  according to the formule  $C = K^1 \times g \times P$ .

If the values of  $P$  and  $g$  are estimated in kilogrammes it is enough, in order to obtain the growth ration in terms of starch units, to multiply their product by the constant factor 0.005.

LEROY, the Head of the Stock-breeding work of the National Agricultural Institute of Paris, compared the findings by this law with the results of the most recent researches on the growth of animal organisms and states that the two series of results were very nearly the same.

In order to carry out this comparison he adopted the following procedure.

The value of the growth ration is probably in close relation to the daily fixation of energy in the animal's body and this amount of energy corresponds to the heat produced by the combustion of the nitrogenous and fatty substances accumulated every day by the organism. In order to obtain a preliminary approximation it therefore seems permissible to take together the energy value of the growth ration and the energy represented by the growth constituents.

The heat generated by the combustion of the substances fixed in the bodies of animals as a result of growth varies considerably with the age of the individual. The tissues of adult animals are much richer in dry substances and fat than the tissues of young animals.

As equal weights of fat contain 2.2 times more energy than is contained in the other growth materials, equal weights of the tissues formed during the first months of life represent a lower energy gain than the tissues formed later.

A curve could be drawn representing, in function of time, the variations in the energy fixed per kg. of increase in weight in the case of ruminants. As the data for constructing it are too scanty it seems logical to merge the curve, at all events for ages between five months and two years, into a straight line and to assume that the increase in energy per kg. of growth during the corresponding period is a linear function of the time.

The equation of the straight line has the form  $\frac{a}{\alpha} + bt$ ,  $a$  and  $b$  being the coefficient constants.

If  $C$  represents the energy gain per kg. expressed as starch units and  $t$  is the age of the animal in days, the equation of the straight line is as follows:

$$C = 0.9 + 0.0028 t.$$

According to this equation, a two-year-old calf which daily gains 0.800 kg. increases its energy supply by

$$(0.9 + 0.0028 \times 360) \times 0.8 = 1.54 \text{ starch units.}$$

It must therefore be able to obtain this amount of energy from its daily ration in addition to satisfying its maintenance needs.

On the other hand, when young cattle are systematically fed, their daily live-weight gain may be regarded as practically constant and somewhere between 0.5 and 1 kg. according to the early or late maturity of the breed to which the animal belongs. The constancy of this gain makes it possible to calculate the live weight  $P$  of the animal at any age  $t$  by means of the formula  $P = p + gt$ , in which  $p$  is the weight of the calf at birth.

The relation  $\frac{C}{g + P}$  or  $\frac{\text{energy value of growth ration}}{\text{live weight} + \text{daily gain}}$

can therefore be expressed by the equation :

$$\frac{C}{g \times P} = \frac{(0.9 + 0.0028t) \times g}{(p + gt) \times g} = \frac{0.9 + 0.0028t}{p + gt}$$

In animals of rapid growth, this relation can be considered as independent of the time  $t$ , and equal to the constant 0.005.

If in the expression  $\frac{0.9 + 0.0028t}{p + gt}$  the successive values 1 kg. ; 0.9 kg. ; 0.8 kg. ; 0.7 kg. are given to  $g$ , and on the other hand, the values 200 ; 300 ; 400 ; 500 ; 600 days are subtracted from the time  $t$ ; and if we further suppose that the weight of the calf at birth was 40 kg. the values of the relation  $\frac{C}{g \times p}$  given in Table V. are obtained.

It is to be expected that there will be large deviations between the calculated and the real figures. Early maturity, for instance, may alter the results.

TABLE V. — Values of the Relation  $\frac{C}{g \times p}$

Values of $t$ days	Values of $g$ .			
	1 kg.	0,9 kg.	0,8 kg.	0,7 kg.
200	0.0061	0.0066	0.0073	0.0081
300	0.0051	0.0056	0.0062	0.0069
400	0.0046	0.0050	0.0056	0.0063
500	0.0043	0.0047	0.0052	0.0059
600	0.0040	0.0044	0.0049	0.0056

The author compares the data of GOVIN and ANDOUARD with those obtained by KELLNER and by T. L. HAECKER (*University of Minnesota Agricultural Experiment Station Bulletin* 156, 1916) (see Table VI), and

expresses his opinion that the forecasts made according to KELLNERS' rules are manifestly too high, at all events during the first year of growth.

TABLE VI. — *Comparison of the values obtained respectively by GOUIN and ANDOUARD, KELLNER, HAECKER.*

Age of animal in days	Weight in kg.	Daily gain in kg.	Expected value of growth ration			Growth ration actually fed
			According to GOUIN and ANDOUARD $C = K^1 \times g \times P$	According to the formula $C = (0.9 + 0.0028 t) g$	According to KELLNER	
			Starch-units	Starch-units	Starch-units	
218	204	0.750	0.77	1.13	1.68	1.29
280	249	0.750	0.94	1.26	1.87	1.22
238	294	0.750	1.10	1.39	1.87	1.40
400	340	0.750	1.28	1.51	1.88	1.99

F. D.

851 — **Butter-Fat Percentage of Cow's Milk Increased for Two Days by Partial Milking.** — REGAN, W. M. and MEAD, S. W. (Dairy Department, New Jersey Agricultural Experiment Station, New Brunswick), in *Journal of Dairy Science*, Vol. IV, No. 6, pp. 495-509. Baltimore, November, 1921

In the supervision of advanced registry tests, it is required that cows be milked dry at the milking preceding the test period. This entails considerable loss of time and expense and the question has arisen as to the necessity for the operation.

The author carried out some experiments with Holstein, Jersey and Ayrshire cows. The animals were milked dry twice daily for 6 days; on the 7th day only half the milk was drawn, and during the 4 subsequent milkings, the cows were again milked dry.

Samples were taken at each milking and tested, for butter-fat. It was found possible to increase the percentage of butter-fat in milk during a period of 2 days by leaving half the milk in the udder during the milking prior to the two-day period. Although the average increase in butter-fat was only 0.27 % the data collected seem to show that it is possible to obtain an increase of over 0.5 per cent by leaving a certain amount of milk in the udder, but if too much is left, the contrary effect is produced. The highest fat percentage was not always reached at the milking following the partial milking; it was only attained in 12 out of the 27 trials. As there was an average increase of only 0.766 lb. of milk for the two days following the partial milking, the practice of leaving part of the milk in the udder could not be detected by a study of the cow's milk record.

The data collected in this experiment show that a preliminary milking is necessary as a measure for safe-guarding the accuracy of advanced registry testing.

F. D.



- 852 - **Effect of Temperature on the Fat Percentage of Milk.** — RAGSDALE, Q. C., and BRODY, S. (University of Missouri, Columbia), in *Journal of Dairy Science*, Vol. V, No. 2, pp. 212-215. Baltimore, March 1922.

It is well-known that a correlation exists between the season of the year and the fat content of milk, which is lowest in summer and highest in winter. HECKLES states that this variation is found in the case of cows fed the same rations and in the same period of lactation; it therefore appears to depend directly on differences in temperature.

The authors carried out an experimental test which proved the correctness of this hypothesis. All other factors being equal, and within the limits of the experiment (from  $-3^{\circ}\text{C}$  to  $+21^{\circ}\text{C}$ ), the fat content of milk is highest when the temperature is lowest. F. D.

- 853 - **The Zebu of Madagascar regarded as a Meat Producer.** — CHRÉTIEN, M. (Vétérinaire aide-major de 1<sup>re</sup> Classe, Charge de la surveillance de l'usine de la Montagne d'Ambre [1917-1919]), in *Revue de Zootechnie*, No. 5, pp. 395-409, Paris, Feb. 15 1922.

The author begins with a description of the shape and the method of rearing the Zebu cattle of Madagascar, and the enumeration of the diseases which he has observed during the lifetime of the animal and of its external parasites (1). Although this animal is generally good-tempered, it is not wise to handle it, hence it must be judged exclusively by sight. The author indicates the shape which should be looked for in a good meat-producing animal.

Examining after slaughter the characters of the meat of "herbivorous animals", the first thing that strikes one is the almost entire absence of covering fat. The hump is formed of fatty tissue in the middle of which are buried scanty muscular fibres. The fat of the splanchnic cavities is much less abundant than that in cattle of French races, even of poor quality. In the thoracic cavity the amount of the fatty masses of the mediastine and of the apex of the heart is insignificant. That fat is generally of a very faintly yellowish white. When cut up the various muscular sections appear of a plain shining red. But the muscular juice seems scanty; the grain of the muscle lacks fineness and the "mottled" appearance so much prized in French races is never found. The fat seems to be almost exclusively accumulated in the hump.

**DETERIORATIONS OF THE MUSCULAR TISSUE.** — The author has never noticed meat of the "feverish" or "fever of fatigue" type, nor of "hydrohemia". The muscle was always quite red. On the other hand, local injuries were common and often necessitated large "picking out".

**DISEASES NOTICED AFTER SLAUGHTER.** — These are very few. A few cases of local pleurisy in the thoracic cavity and localised abscesses; some in the region of the scrotum and consequent on castration, others in shoulder parts or on the withers. The other diseases noted and having

(1) See R. Jan. 1919, pp. 1-12. Article by M. George CARLÉ, Stock Breeding in Madagascar, and R. Dec. 1921, No. 1252. (Ed.)

no appreciable effect on the general state of the animals were due to the following parasites.

*Echinococcus*:— in the liver, very rare.

*Filaria of the peritoneum*:— fairly frequent.

*Periligamentous and peritendineous onchoceres (sucking-worms) of the conjunctiva*:— in all the animals.

Out of 108 037 animals examined the author only noticed two cases of tuberculosis. But this disease is much more frequent in the breeding places in the centre and south.

**YIELD.** — It varies little and may be estimated at from 48 to 52 %. The proportion between the weight of the fore and hind quarters is always greater than unity, inversely to that which is the case with improved races. From the 2nd August 1914 to the 31st December 1916 the average net weight calculated on 48 072 animals was 159 kg. From January 1917 to August 1919, the monthly variations in the average net weight varied between 135 and 155 kg.

**UTILISATION OF THE ZEBU OX OF MADAGASCAR FOR MAKING CANNED-MEAT.** — The yield for making the French preserve called "spiced beef" varies from 212 to 236. This figure indicates the quantity of dressed meat necessary for making one kilogramme of preserve including fat and broth. This yield is practically the same as that of French oxen. The author adds that the native staff use all necessary cleanliness in the making of the preserves.

**CONCLUSIONS.** — Although of small size and weight, the zebu ox of Madagascar was valuable during the war, and supplied a satisfactory canned meat. The zebu ox may therefore be recommended for breeding purposes with a view to improvement of the race. The author indicates the measures to be taken and concludes that the native should not be relied on, but that the grant to colonists of large concessions in the regions where there are water holes would enable good results to be obtained.

F. S.

#### SHEEP

854 — **Notes for a History of the French Breed of Sheep of La Charmoise.** — LAPLAND, M. and GARNIER, A., in *Revue de Zootechnie*, No. 5, pp. 447-462 Paris, Feb 15, 1922.

MALINGIÉ bought in 1835 the farm of La Charmoise, at Pontlevoy (Loir-et-Cher), and a flock of Kent sheep of pure breed and particularly well shaped. He then decided to found a race by making the following crossing: *Kent* or *New Kent* × ewe of mixed blood having in approximately equal proportions Solognot, Berrichon, Laurangeau and Merino blood. He obtained a well shaped offspring which presented within a very short time an absolute fixity of characters.

Such is the history of the Charmoise breed.

The question of the real existence of the Charmoise breed arises. SANSON has definitely proved that the Charmoise was not a separate breed while BARON has substantiated a contrary opinion. The authors think that the differences of opinion depend mainly on the understanding of what a breed is. As proof they mention the question of pigmentation. There

is a tendency at the present time to suppress pigmentation, but it is hereditary, and when MALINGIÉ established the Charmoise breed the constituent races were all slightly pigmented. Nor is it either useful or important that the Charmoise breed should be depigmented, for this question does not affect the meat. However, if the pure breed is to be at all times what it ought to be, it is certain that it changes continually; and, for the sheep of the Charmoise race, the causes of variation from type are:— 1) a natural geological cause; 2) artificial causes:— selection and crossing.

In 1919, the estate of Vaulx-de-Cernay in the neighbourhood of Paris bought a lot of about 120 sheep (ewes, tegs, lambs and rams).

In 1920, more than 65 % were eliminated and only 41 ewes were retained. On January 26, 1921, the estate acquired from M. TH. VAILLANT of Guélis his flock of pure Charmoise race. This flock had been purchased in 1859 from M. Ch. MALINGIÉ, and was one of two lots which constituted, on the death of M. MALINGIÉ senior, the founders of the Charmoise breed. It is on these two flocks, one bought in 1919 and the other in 1921, that the authors have made their observations. They first of all made an ocular examination of the type of Charmoise sheep in the group at Vaulx-de-Cernay and in the group coming from M. VAILLANT of Guélis, and afterwards a detailed examination in the course of which they passed successively in review the cephalic type, the pigmentation, the weights and the measurements. They concluded that it is quite remarkable to see how much the characters have remained alike after 70 years, in groups having the same origin; that the Charmoise breed is as homogeneous and as pure as any other; and that some evolution of the types is a necessity and is of general occurrence. F. S.

**855 - Sheep of Catalonia, Spain.** -- CASABOSCH, D., in *El Cultivador Moderno*, Vol. XII, No. 3, pp. 3-4, figs. 2. Barcelona, March 1922.

According to the writer there remain now in Spain very few flocks in which crossing with some foreign ram (Leicester, Cheviot, etc.) has not been tried, which is unfortunate, as the country possesses the founders of the renowned Merino race, which has been used for improving breeds in so many countries and has given rise to the fine and numerous sheep of South America. In Catalonia the sheep are of three principal races:— "Valle de Ribas", "Sagarrenca", and "Pallars" or Catalonian properly so called. This latter has its centre in the country of Pallars; it is hornless (with the exception of a few horned individuals); the head is straight in profile; the fleece white marked with black on the head, especially round the eyes; the head, legs and belly are not covered with wool, which is fairly open, heavy, excellent for making mattresses, very much in request for cloth, its staple being fine, long, undulating, soft, without coarse hairs, and of regular diameter; this race is a good milk producer, as for 2 months after weaning half a litre of milk per day is obtained. The second show of rams of the Catalonian race took place recently at Valle di Aneo. The prize winners (all of the Pallars race)

gave the following measurements:— average height 77 cm. length 116 cm. thoracic girth 98 cm. breadth between the haunches 24 cm. The purchase of the wool is made by monopolists, by weight without any classification; the author urges that at the Shows the classification of wool should be taught to breeders, and that they should arrange to have it applied.

F. D.

**856 - Romney Marsh Sheep in New Zealand.** — MATTHEWS, A., in the *Pastoral Review*, Vol. XXX\*, No. 12, pp. 963-965. Melbourne, December 1921.

The typical Romney Marsh sheep is hornless, well-covered with wool, broad and flat between the ears, which are large and thick and covered with fine hair or down. The muzzle is full and not too white in the ewes, and broad and masculine in the rams; the eyes are large, bright and prominent; the nose is coal-black; the neck strong and thick and well-planted on the shoulders, which are broad and level with the back. Relatively high shoulders are characteristic of bad travellers. The chest is large and deep; the back straight; the loins wide and flat; the ribs well-sprung and giving a round appearance to the body; the rump is wide, long and well-rounded; the thighs well set down and developed. The tail ought to be set almost level with the chin, as ewes with low set tails are often bad breeders; legs should be short with big bones and the trotters large and black. The fleece should be close, not tangled and as uniform as possible in quality from head to tail; the wool long and crimped, lustrous and soft and easily combed; it should be free from patches of white hair which are hard and brittle and cause difficulties in woollen manufactures. A clean, pink coloured skin is an indication of good health and constitution.

The sheep of this breed are very prolific and are able to thrive from sea-level up to an altitude of 5 000 to 6 000 feet. They were introduced into New Zealand in 1853 from Kent and the purity of the breed has been maintained by fresh importations from the Home Country.

The first flock book for New Zealand was published in 1895 and recorded 51 Romney Marsh Flocks. Since then there has been a steady increase in numbers and in 1920 the Flock Book records a total of 139 470 head of this breed out of a total of 287 000 for all breeds (1). There has also been a great improvement in quality and New Zealand Romney Marsh sheep compare very favourably with those raised in England. The local breeders have always been careful in selection until they have in course of time produced some of the finest examples of the breed, carrying wool wherever it is possible to grow. Moreover the wool is so comparatively soft that Romney Marsh sheep are used for crossing with Lincolns to tone down the harshness of the Lincoln wool.

Before the Great War the export of Romney Marsh sheep was on a fairly large scale, mostly to North and South America; this was interrupted by the outbreak of hostilities but has been resumed and

(1) The predominance of this breed is especially noticeable in the North Island; — 88 967 Romney marsh sheep out of 133 846.

must grow considerably, not only on account of the intrinsic value of the breed but also because the number of sheep raised in New Zealand so far exceeds local requirements.

E. F.

- 857 - **The Present Condition of Merino Sheep Breeding in Australia.** — I. The World's Live Stock, *The Pastoral Review*, Vol. XXXI, No. 10, p. 784. Melbourne, October 1921. — II. ABBOTT, W. E., The World's Supply of Merino Sheep, *Ibidem*, Vol. XXXI, No. 12, pp. 964-965. Melbourne, December 1921.

In 1891, Australia possessed 106 million sheep, of which over 100 million belonged to the Merino breed; before the War, the number had fallen to 83 046 000, and in 1920, there were but 73 002 000 sheep including only 50 million Merinoes. Thus, within the short period of about 30 years, the stock had decreased 50 %, in spite of the fact that from 1891 to the present day, many million acres have been laid down to pasture, while enormous sums have been expended on the improvement of already-existing pastures. This great reduction in the flocks has been concealed to a certain extent by the rapid rise in the price of wool which has kept up the export returns.

In the author's opinion, the diminution in the number of sheep is due to two main causes: 1) the serious increase in rabbits; 2) the attacks of the blue fly (*Calliphora* spp.) (1), an insect to which Merino Sheep are more susceptible than any other breed.

The author severely criticises the Rabbit Control laws passed by the Australian Government and asserts that on a property where the poisons have been continually spread for 10 to 15 years, all the small carnivora and insectivorous birds have been destroyed, thus leaving the field clear for the invasion of rabbits and the blue fly.

F. F.

- 858 - **The Effect of Food upon the Fat Content of Goat's Milk.** — SHEELY, F. J., in *The Scientific Proceedings of the Royal Dublin Society*, Vol. XVI, Nos. 35-39, pp. 478-488, diagrams 3, bibliography of 11 works. Dublin, 1922.

GOATS

The author attributes the contradictory results obtained by his various predecessors who have experimentally studied the effect of food upon the fat content of milk to the fact that most of the animals were in good condition and liberally fed, so that any changes due to alteration in diet were difficult to detect. Moreover, as one food was substituted for another, the part played by the different constituents of the ration had also to be taken into account.

For these reasons, he decided to devote his attention to the question, but instead of choosing a cow for his experiments, he took a goat of the old Irish breed. After determining the amount of food required to maintain the live weight and normal milk yield of the animal, the author added various quantities of simple foods such as roots, farinaceous substances and soy bean oil and observed their effect upon the fat content of the milk.

(1) See: *R. Dec.* 1918, No. 1374 (*Ed.*)

The rations fed per head and per day were :

- A) 37 days : hay *ad. lib.* + mangels 6.4 kg. + crushed oats, bran and brewers' grains 0.68 kg.
- B) 21 days : hay *ad. lib.* + mangels 4.5 kg. + skim milk powder 0.58 kg.
- C) 24 days : Ration B + 0.21 kg. soy-bean oil.
- D) 11 days : ration C, without the mangels.
- E) 21 days : hay 0.45 kg., turnips 4.5 kg. + oats 0.38 kg.
- F) 20 days : Ration E + 0.23 kg. of soy-bean oil.
- G) 23 days : Ration F + 0.23 kg. of soy-bean oil.
- H) 17 days : hay 0.45 kg. + turnips 4.5 kg. + oats 0.38 kg.

The passage from ration A to ration B produced no change in the quantity of milk, but decreased its fat content.

The passage from ration C to ration D caused a considerable decrease both in the amount of milk and in its fat content.

The passage from ration E to ration F caused no change in the amount of milk, but the fat content was increased.

The passage from ration F to ration G did not alter the milk yield, but increased the fat content.

The passage from ration G to ration H produced no change in the amount of milk, but reduced the fat content.

The same results were obtained with all three goats used in the experiment.

It might be assumed therefore that in the case of the goat, a considerable reduction of the ration may cause a lowering of the fat content of the milk.

In order to obtain an increase in the percentage, and total amount of fat in milk, starch, fatty substances and protein can be substituted for one another ; when the minimum of protein is to be given, equal quantities of starch and of casein can be interchanged.

Foods added to the ration gradually lose their effect in increasing the fat percentage of the milk as the fat content approaches its maximum, but there is a progressive rise in the live-weight, or milk yield, or even of both together.

F. D.

#### PIGS

859 — “ **Large Black** ” Pigs in Italy. — I. La razza Large Black, *L'Industria lattiera e zootecnica*, Vol. XX, No. 5, pp. 57-59, fig. 1 Reggio-Emilia, May 1922. — II. FRACANZANI, G. A., Il maiale Large Black, in *Allevamenti*, Vol. III, 5th part, pp. 163-164, fig. 1. Palermo, 10 May 1922. — III. BONDON, C., La suinicultura I Stanga di Grotta d'Adda, in *Il Coltivatore*, Vol. LXVIII, No. 11, pp. 342-345, figs. 4 ; No. 12, pp. 374-376, figs. 2 Casale Monferrato, 20 and 30 Apr. 1922.

I. — Two new races of pigs are at present recommended in Italy for mixed rearing “ *semibrado* ” (for keeping in styes alternating with free pasture) : — the English “ *Large Black* ” and the American “ *Po-land China* ”. The former which is obtained in the South of England by crossing the local breed with the Chinese pig and with the Caserta breed, has shown, on the whole, greater hardiness and precocity than the Yorkshire ; it is better suited to pasturage and more resistant to heat. Its offspring, however, does not always reach the weight of the Yorkshire

The most important breeding centre of this race in Italy is in the zone of Reggio Emilia, where conditions are very favourable, and it is possible to utilise the by-products of the cheese industry, which is so important in the district; the pigs which are slaughtered attain the enormous weight of 2 qx. to 2 ½ qx. In the provinces of Bologna and Forlì, pigs are killed over 2 and even 3 qx in weight. Often these heavy weights, are given by crosses of Yorkshire with the Romagno or with the Tuscan. If the production of great weight is aimed at, the Berkshire does not meet with much favour as it produced smaller pigs.

But the Large Black can give the same weights as the Yorkshire, and has also the advantages mentioned above; it therefore seems perfectly justifiable to recommend its diffusion. Meanwhile, in the Royal Dépôt of animal improvers at Reggio Emilia, Large Black boars have been introduced and it has been noted that they are very suitable for giving fresh blood to the descendants of degenerated Yorkshire sows, several breeders have made use of them for industrial crossing in the first generation with the Yorkshire.

At the Royal Dépôt at Reggio Emilia, the following facts have been ascertained. — a Large Black sow of 2 ½ years gave birth to a litter of 6; she suckled 5 of them; they had at birth a weight of 2.5 kg; 30 days later, 8.18 kg.; in 60 days, 15.7 kg.; in 90 days, 28.7 kg.; the same sow, at the age of 2 years, gave birth to a litter of 8; she suckled 7, the weights of which were: — at birth, at 30, at 60, at 90 days, respectively 2.7 kg.; 8.0 kg.; 26.5 kg.; a Large White sow of 1 ½ years gave birth to a litter of 6, she suckled 5 of them; the weights — at their birth — at 30, 60, 90 days, were respectively, 2.3 kg.; 9.0 kg.; 19.0 kg.; 29.0 kg.; the same sow at the age of 2 years produced a litter of 8, all of which she suckled; their weights — at birth, at 30, at 60 days were, respectively, 2.03 kg.; 7.7 kg.; 16.1 kg.; a Large Black × Large White sow of 2 ½ years produced a litter of 12; she suckled 11 of them; their weights — at birth, at 30, 60, 90 days were respectively, 2.1 kg.; 7.3 kg.; 14.0 kg.; 24.0 kg.

The data relating to the weights of the breeding animals of both sexes and of the two races at the age of 3 to 11 months show that on the whole they are about equal.

II. — Dr. FRACANZANI, in rearing the Large Black, has noted that it stands heat and is fairly resistant to humidity, provided it is not too prolonged, and as compared with the Yorkshire, it is less exacting as to food and housing; it is hardier and the flesh has more flavour. One of his boars, purchased from the STANGA breeding establishment, weighed 418 kg and had the following measurements: — length 1.92 m.; height of the forequarters 0.94 m.; of the hindquarters 0.96 m.; thoracic girth 1.68 m.

The sow gives plenty of milk, is very docile and gives good results even when reared in preference on pasture; she can be fed on good lucerne hay chopped, or still better on clover; and benefits very much from a certain amount of oil-cake in the clover months.

In a breeding station at Porto Recanati (Province of Pesaro), for animals kept at pasture supplemented by concentrates, the weights of 145 to 185 kg. — 233 — 286 — 329 — 319 to 351 kg. were obtained respectively at the age of 9 — 13 — 16 — 19 — 23 months.

III. — Description of a large Establishment for breeding pigs established at Grotta d'Adda (province of Cremona) by Marquis Idelfonso STANGA (1) and specialised for the production of breeding animals of pure race.

During the fine weather, the animals are often kept on pasture; the basic ration consists of maize meal, chopped lucerne (obtained with the SMALLEY chopping machine, "tankage" (meal of meat, blood or fish) to which a mixture of mineral substances is added. When in winter the pigs cannot enjoy pasture, they are given marcita.

At present three races. — Large Black, Poland China, Chester White are mainly being bred.

The Large Black race is gradually replacing the Large White, especially in Central and Southern Italy, for it is more vigorous, more suited to "semibrado" rearing, and responds better to the requirements of the market for the qualities of its flesh. The Poland China was imported for the first time directly from the United States into Italy by the Marquis STANGA in the autumn of 1920, and the Chester White in the summer of 1921. These two races are also very vigorous and with suitable treatment, can give a high yield.

The crosses Large White  $\times$  Large Black have been very successful with customers.

The Establishment also breeds on a smaller scale the Large White, Berkshire and Gloucester Old Spot races.

F. D.

**860 - Remarkable Specimens of Pigs of the Iberian Breed, in Spain.** — *La Industria pecuaria*, Vol. XXIII, No. 724, pp. 101-103, figs. 4. Madrid, March 1922.

The heavy weight reached by pigs of the Iberian breed, raised on pasture and fattened by feeding with acorns in the district of Jaburgo, Sierra Morena (Spain), is reported.

Pigs of 2 years old, and even less, gave an average live weight of 230 kg. and animals of about 3 years old gave an average live weight of 368 kg.

One specimen in the latter group had the following measurements:— length 1.85 m.; thoracic girth 2.22 m.; height at withers 1.10 m.; width of the quarter 0.57 m.

These results show to what degree the Iberian breed can be perfected: it is a race remarkable for its hardiness and the choiceness of the meat and lard which it produces.

F. D.

(1) See: — Marchese T. STANGA, *Suinicoltura praticata*, Milan, Hoepli, 1915. (Ed.)



- 861 - **The Effect of Breeding on Immature Sows.** — I. MUMFORD, F. B., *The Effect on Growth of Breeding Immature Animals*, in *University of Missouri, College of Agriculture, Agricultural Experiment Station, Research Bulletin* 45, 37 pp., diagrams 12, bibliography of 8 works. — II. *IDEM*, *The Effect of Lactation on Young Sows*, in *The Breeder's Gazette*, Vol. LXXXI, No. 7, p. 217. Chicago, February 16, 1922.

I and II. — The following facts have been observed by the author during the course of a long series of experimental researches :

Although gestation does not retard growth in sows, lactation hinders development, for however liberal the food supply, it is all used in the production of milk, and at the end of the lactation period, the sow is found to have lost considerably in weight and to some extent in height and length of body. A young sow of the same age, but not suckling pigs increases in weight and size during the same period of time.

This arrest and therefore retardation of development is not, however, permanent, for the rate of growth between two successive lactation periods is greater than in the case of young unfertilised sows. The compensation is only partial, for it has been found by careful measurement that if a sow is fertilised at the first heat period and produces two litters a year while she is growing, she will be actually smaller at full maturity than an animal that is not fertilised so early. Further she will not reach full maturity till one year later.

It should, however, be remarked that the difference in size is never sufficient to have any real commercial significance. E. F.

- 862 - **The Bresse breed.** — VOITELLIER, CH., in *Revue de Zootechnie*, No 7, pp. 703-709, Paris, 15 Apl. 1922.

POULTRY

The high price of eggs and poultry since the war has certainly been the predominant factor in the extension of practical poultry keeping which is to be noticed in every part of France. For some reason or other, the people who proposed to start or to improve a poultry farm, gave their preference to the Bresse breed, and it is a question whether the choice is justified. A very marked current of opinion had already set in, in the last ten years before the war, in favour of poultry without any superfluous attributes, such as tufts, over-developed combs, throats or peculiarities of plumage which are regarded as unfavourable to good maintenance or to the good health of the poultry. Everywhere, on farms, any other kind of country residence, where a fixed space is allotted to poultry, whether relatively large or small for the number of birds, where specialisation is required and intensive production of eggs indicated, the only points to be considered are the real aptitude of the fowls to transform their food into eggs, the weight and colour of the eggs, and the conditions of the laying. The larger breeds, obliged to consume more up to the time when their growth is almost complete and the first egg is laid, have for that reason been eliminated as soon as their productivity was proved not to be exceptional. Everywhere where there was no local breed answering to the conception of the ideal hen from a practical standpoint, people were led by one inference after another to adopt the Bresse breed, and especially the typical black variety. It was blamed for its

small size, but it was also known that its flesh is very delicate. It was also noticed that the search for a big fowl was generally a mistake, because on the market the fowl of medium or small size, found more purchasers and was finally bought at a higher rate per kilogramme. However, there was no certainty as to its laying capacity. In adopting it, one had only a relatively good chance of finding individuals that were very good layers. If unsuccessful, one was at any rate in possession of a good breed for table purposes. This was, to sum up, the reasoning generally adopted.

As a matter of fact, the forecast of its laying qualities have been partly realised. The large number of fowls of this breed shown at the last Grand Palais Show enabled the judges to lay down precisely their views regarding external characters. They gave prizes only for fowls with combs and gills of fine texture and medium size, with well marked pure white ears, with long bodies, wide and deep behind, with well set tails making a decided obtuse angle with the line of the back.

Grey or white varieties, rather larger in size, possess the original qualities of the black and it is quite possible that, if submitted to methodical selection, they would quickly give similar results. F. S.

863 - **A little known South American species of Fowl: - the "Colloncas de Aretes" of Chili (*Gallus inauris*).** — CASTELLO, D (Director of the Royal School of Poultry Rearing at Arcnys del Mar), in *Bassa Corte*, Vol III, No. 54, pp 1161-1164. Mola-sana (Genoa), June 1922.

The writer found in Chili a species of fowl which, although very old, is unknown to poultry rearers in Europe and North America, and to most of those in South America; according to the description given in his report "Avicultura en las Américas latinas" presented to the Universal Congress of Aviculture at the Hague (1921), this species received the name of *Gallus inauris*, that is to say ear-ring or (more accurately) tufted fowl. The birds are characterised by a small crest which has a spheroidal tuft of feathers, on both sides, over the ears, and by the complete absence of tail, due to the non-existence of the vertebrae of the coccyx.

The dimensions are normal or slightly less than normal, the plumage is very varied (the finest fowls are white or white with red wings); the eggs have a greenish blue shell, sometime spotted with brown.

In South America these fowls are called "colloncas", that is to say tail-less, or "de aretes" that is to say with tuft, or (combining both features), "colloncas de aretes.

The author and Dr. Bustos exhibited a selected group of these fowls at the Santiago de Chili Show in 1914.

This species is found not only in Chili, but also in Bolivia, Peru, Colombia and Ecuador; it is largely kept by Indians.

Crossed with European breeds, it lays bluish eggs. From several historical, philological and zoological sources the author concludes that it is a case of a native species derived from a wild race which has now disappeared, and differing from the *Gallus Bankiva*, the original source

of the fowls of the American continent, and from breeds imported from Europe into America.

F. D.

864 - **Egg Laying Characteristics of the Hen.** — DRYDEN, J. in *Oregon Agricultural College Experiment Station, Bulletin 180*, pp 1-96, Tables 74, figs 26. Corvallis, Oregon, Aug. 1921.

Results of breeding experiments begun in 1908 with Barred Plymouth Rock and Single Comb White Leghorn pullets. The cross-breeds known as the Oregon breed gave 201 eggs the first year, Plymouth Rock, 164 and White Leghorn 183.

During certain years selection was based on trap-nest records, but as a rule laying hens were chosen according pedigree. The annual production was increased by removal of unsatisfactory layers but individual variation was still evident, ranging from 0 to more than 300 eggs in a year.

This variation does not appear to be a breed characteristic. The highest individual record among the Barred Plymouth Rocks was 308 and the lowest 3; for White Leghorns, 302 and 1 respectively; for Ore-gons, 309 and 14. Breeding has apparently no definite effect on decrease in variation; the range between high and low remains almost the same.

The highest egg record for one year was 218 for the foundation stock; this was increased to 308 for the pedigreed stock. In one case with 17 super-quality hens (laying 300 eggs or more), a record of 330 eggs was secured.

The hens of high record stock gave a marked increase in production over the unselected, poor-laying foundation stock; high fecundity is therefore hereditary. Regardless of any question of prepotency, the selection of breeding stock on the basis of high production record is a certain method of increasing production.

Certain individual cases showed greater power of transmitting high fecundity than others. More satisfactory progress will be made, therefore, if only hens and cocks are selected for breeding which are already noted for transmitting this characteristic. The average egg production the first laying year was less when the parents were selected from the highest produces than in subsequent years, but in certain individual cases the production was exceptionally high the first year.

The best layers continue to maintain the increased egg production; selection gives in reality a higher rate at the end than at the beginning of the year.

The number of eggs laid during the two most active months, March and April, is a fairly accurate basis on which to select good laying hens. Late laying in the summer and autumn does not always indicate a good layer.

The highest egg production is obtained in the first year; the following years there is a decrease. The greatest decrease was with hens with highest first year records; when the production was very low the first

year, there was on an average an increased production in the second year.

There appears to be a correlation between rate of laying and the fat content of the eggs. F. D.

## BEE-KEEPING

865 - **Studies on Bee-Keeping in the United States.** — I. DEMUTH, G. S., Swarm Control, in *Farmers' Bulletin* 1198, *United States Department of Agriculture*, pp. 47. Washington, June 1921. — II. MILNER, R. D. and DEMUTH, G. S., Heat Production of Honey bees in Winter, in *U. S. Department of Agriculture, Bulletin* 988, 18 pp., diag. 4, December 5, 1921. — III. PHILLIPS, E. F., The Occurrence of Diseases in Adult Bees, in *U. S. Department of Agriculture, Department Circular*, 218, 16 pp. bibliography of 23 works, March 1922.

I. — **THE CONTROL OF SWARMING.** — The author discusses the factors contributing to the tendency to swarm and to natural swarming and the best means of prevention. He then gives a detailed account of the most important measures of swarm prevention viz:

1) Careful selection of stock in breeding as some strains of bees have a stronger tendency to swarm than others.

2) The use in the spring of brood-chambers and hives large enough to hold the maximum amount of brood without crowding.

3) The use of good worker combs in the brood chamber to obviate a reduction in the available brood-rearing space.

4) The arrangement of the brood combs so as to avoid placing barriers in the way of a free expansion of the brood nest during the spring.

5) Providing extra space for the bees within the brood chamber by wider spacing of combs and a deep space below the frames.

6) The use of large entrances during the swarming season, especially when the weather is hot, and in some cases, additional openings for ventilation.

7) Protection of the hives from the direct rays of the sun by the use of shade-boards or double covers, or by painting the hives white, especially the cover.

8) Preventing the building of barriers of sealed honey around the brood-nest, or breaking down such barriers if they exist.

9) Inducing the bees to occupy supers as soon as the honey-flow permits during the first half of the season, or when the colony is rapidly increasing.

10) Providing extra combs for the ripening of the nectar, so that the field bees can dispose of it as soon as they reach the hive, to prevent any stagnation of the activities of the colony.

11) Removing some of the emerging brood to reduce the number of emerging bees within the brood-chamber, thus producing a better distribution of the bees throughout the hive.

12) The destruction of the queen-cells, provided they have been but recently started. Frequently however when they have been destroyed, other cells are immediately formed.

Finally, as a remedy for swarming, the bee-keeper relieves the con-

gestion of bees within the brood-nest by creating conditions comparable either to the swarm, or to the parent colony in nature.

II. — HEAT PRODUCTION OF BEES IN WINTER. — Continuation of the researches published in *U. S. Department of Agriculture Bulletin*, 93, 1914 (1).

A small colony on 4 combs having natural honey stores was placed in the chamber of a respiration calorimeter and their carbon-dioxide production and oxygen consumption were measured for 10 days while the temperature of the air surrounding the bees was kept just low enough for them to remain clustered. There were 14 thermo-couples distributed in the hive in the calorimeter so as to register the temperature of different points inside and outside the cluster. The temperatures were read every half hour day and night for about 12 days. The readings were plotted on charts, and the results thus obtained led to the following conclusions.

In the colony of bees under observation in the respiration chamber, the expenditure of energy was reduced to the lowest limit by the maintenance of a favourable temperature and the avoidance of all disturbing factors.

In these circumstances, which are rarely found in the apiary, the energy developed by the bees as measured by the carbon dioxide and water produced and the oxygen consumed was greater according to body-weight than that developed by a man engaged in hard manual labour when it is realised that the work was done by only a few of the bees in the cluster. Even assuming that the work of the period was equally distributed among the bees, their energy output per unit of body weight is higher than that of the average labourer. Since bees do not usually have such favourable conditions in winter, it is clear that the energy output is enormous in the average apiary.

III. — DISEASES OF ADULT BEES. — The diseases so far known and of which the causes have been revealed by laboratory research are the following. 1) Isle of Wight disease, 2) Nosema disease due to *Nosema apis*; 3) indirect toxic effects of spraying with insecticides containing arsenic salts.

The Isle of Wight disease, caused by *Acarapis (Tarsonemus woodi)* (2), does not exist in the United States, according to specimens sent from the most different parts of the Union for examination by the author. In order to ascertain whether it could be introduced from Great Britain, where it appears to be widely spread the author had two infected hives sent out from England. When the first arrived all the bees, as well as the parasites, were dead; the second arrived with both bees and mites alive. Thus it is proved that the disease can easily be introduced by the importation of infected colonies.

(1) See: *R.* Oct.-Dec 1919, No. 1211; *R.* July 1921, No 748. (Ed.)

(2) See: *R.* Feb. 1920, No. 243. (Ed.)

The *Nosema* parasite already exists in the United States, and is even common there, but it seldom produces serious disease in adult bees in that country.

866 - **The Winter Care of Bees.** — WILSON, H F, in *Agricultural Experiment Station, University of Wisconsin, Bulletin* 338, 26 pp figs 7 Madison, Wis., January 1922  
Practical rules for intensive bee-keeping.

The death of the bees during the winter entails great losses to bee-keepers in Wisconsin (the average winter losses for the entire State are from 15 to 20 %, and sometimes run as high as 30 %), and throughout the northern part of the United States

Successful wintering is, however, possible if the hive is well supplied with good honey and the colony has a queen not more than two years old whose maximum egg-laying period has not been reached. All artificial feeding should be done before November 1. The place where the bees are wintered is of little importance provided other conditions are suitable. The temperature of the bee-cellar must be about 45° to 50° F. Too much ventilation in the cellar may cause serious losses among the bees in winter. The insects must be well protected and sheltered from the prevailing winds in spring, they should be put into their winter quarters early and removed at the beginning of spring, when, however, they still require protection. Bees ought not to be disturbed from November 20 to March 21 and should be kept in absolute darkness

The fundamentals of spring care are: protection during April and May, a large amount of stores, not less than two hive-bodies. Every colony must be provided with more stores than it seems likely to be able to use (40 to 50 lb). A strong colony will need throughout the spring season from 75 to 100 lb of honey or sugar syrup, and if the bees cannot get it in the field, the bee-keeper must supply it

F D

## FARM ENGINEERING.

### AGRICULTURAL MACHINERY AND IMPLEMENTS

867 - **Electricity and Agriculture** (1). — MATTHEWS, R B (Institution of Electrical Engineers), in *Journal of the Royal Society of Arts*, Vol LXX, No 3620, pp 367-368, London, April 7, 1922

The problem of increasing the yield from the numerous small holdings in England and Wales has directed attention to the possibilities of use of electricity on the farm in districts where it is difficult to use gas and coal for machinery etc

The author points out the economic advantages to be derived from electric lighting for cow sheds, the improvement in cleanliness, reduction in waste of milk, cattle food etc. by providing adequate light in habitually darkened buildings. In addition the electric motor can be readily utilised for machine work, for chopping cattle food, working churns, milk separators etc. Such motors are easily handled and require a minimum of la-

(1) See R. Feb. 1920, No 243 (Ed.)

bour. The fact that hay can be dried artificially by means of electrically driven fans gives the farmer more control over his crops and makes him more independent of the weather. Successful results with electric heating for the prevention of frost amongst stores of roots and vegetables have been reported and also for drying fruit in bottling factories etc. The use of electric heat has also already proved its value for incubation purposes, and has given an increased yield of eggs at a time of year when they are of the highest market value. There are undoubtedly great possibilities in its application to milk sterilisation, and ensilage purposes.

Recent experiments on a practical scale have demonstrated that an extremely small amount of electrical power converted in a suitable apparatus to a very high tension and discharged from overhead wires strung across the fields has a remarkable effect upon most forms of vegetable life, increasing yield and in many cases advancing the period of harvest. Although it is at least possible that this effect may be rather in the nature of a stimulant than a food, and due to some effect upon the plant which improves its power of absorbing and assimilating nutriment from suitable soil, there is already sufficient evidence to justify careful and continued research in this direction (1).

M. L. Y.

868 - **Posts supporting Agricultural Electric Wires.** — SOURISSEAU, J. H. (Director of Agricultural Mechanics at Toulouse), in *Journal d'Agriculture pratique*, v 37, No 18, p 365-368, 5 fig Paris, 6 May 1922

In the consideration of any scheme for the distribution of electricity to farms the question of the durability of the supports of the electric wires should receive attention. Experience has shown that any large-scale undertaking for the distribution of electric power is impossible, if it is liable to frequent replacement of the supports. It is necessary therefore to know what kind of post should be adopted for the transmission of electric power to farms. Iron posts are costly to install and to maintain, in spite of of paint many are attacked by rust, chiefly near the ground, and their resistance rapidly weakens in the critical section where the post enters the ground. Posts of re-inforced concrete are difficult to make on the spot and still more costly than iron posts; moreover, their average durability is not yet sufficiently proved by experience. For agricultural lines the wooden post is most suitable but it rots very quickly. Untreated pine posts have an average life of 4 to 5 years, and from 9 to 10 years if they have been treated; fir posts untreated last on the average 7 to 8 years and 12 to 14 years if treated. Their « life » is often less, so that most specifications limit replacement by the contractor at his own expense to posts which become rotten during the second, third and fourth years.

The causes of decay in the wooden posts are in the ground and in the air. The foot of the post rots in the ground chiefly in the 30 cm below the surface of the ground, owing to the attacks of parasitic fungi, which

(1) See R. Nov. 1910, pp 20, 38, 40; R. 1911 Nos. 81, 543, 1175, 1709, 1788, 2684; R. 1912. Nos. 70, 641, 1076, 1282; R. 1913 Nos. 167, 266, 727; R. 1914 Nos 263, 604, 775, 89; R. 1915. No. 17; R. 1916. No 1260; R. 1917. Nos 753, 1202, 1206; R. 1918 Nos. 10, 255, 383, 453, 891, 1085, 1272; R. 1919. Nos. 99, 166, 686, 720; R. 1920. Nos. 273, 245. (Ed.)

grow in the soil and gradually penetrate into the wood ; in very moist soil, in addition to the rotting, decay is also caused by the small mollusks, known as teredos. Above ground the untreated posts are destroyed by termites and borers, followed by alternations of dryness and humidity, the cracks allowing the germs of decomposition to pass inside the wood.

The most effective protection of wood is given by creosote.

The treatment is as follows: the posts, after drying in the air, are further dried to cracking point in a stove by a current of hot dry air, the cracking of the posts does not weaken their resistance under the strain of the wires or under the pressure of the wind, but on the contrary insures that no new crack will open later when the post is in use, the post dried and cracked artificially often loses as much as 20 % of its weight. After drying the posts are placed in a large cylinder in which a vacuum is created by pumping, and the cylinder is then filled with creosote under a pressure of 10 atmospheres, this pressure enables the creosote to penetrate by the cracks to the heart of the posts. The posts thus treated with creosote turn black, and hence are known as "black posts."

Black posts, put up in 1905 and examined by the writer in July 1921 remained in a perfect state of preservation. The author further ascertained that the parts not cracked by the drying before treatment did not crack under atmospheric influences in the course of 17 years service, and that as creosote is insoluble in water, the body of the wood was nowhere affected by rain water. The author also made experiments, in July and August 1921, on the conductivity of the posts. To establish the amount of current conveyed in the two systems, untreated and treated fir posts were set up alongside each other. A thin wired line was attached to the top of the posts by turrets without insulators, the wires of the line were 0.50 apart. An ampèremeter placed on one of the wires indicated the intensity of the current passing along the posts in the test, a voltmeter gave the tension between two of the wires. The values found are given in the following Table.

Posts tested	State of the surface of the posts	Tension in volts	Intensity in ampères
5 black posts of fir 8 m. treated with creosote in 1920 and 1921	dry	536	0.064
	after spraying with water by means of a vine dresser's spray	540	0.070
5 fir posts 9 m. untreated	dry	540	0.250
	after spraying with water by means of a vine dresser's spray	540	5.250

Experiments made on posts treated and set up in 1905 have given currents of intensity sometimes equal to those of the posts treated in 1920 and 1921 and sometimes weaker. To sum up it may be stated that the untreated



ed posts should be provided with insulators. With the black posts, the loss of energy between the wires due to conductivity is small, hence the wires can be fixed directly on to the posts, provided that the current is not utilised when it rains and in the intervals between working. F. P.

### AGRICULTURAL INDUSTRIES.

869 - **New Type of Copal Oil from the Belgian Congo.** — PIERAFRITS, J., in *Cono*, year 3, Vol I No 4, pp. 550-555 Brussels, April 1922

Report of tests and chemical analyses of specimens of copal seed oil from plants growing near Kinda (District of Lulua) in the Belgian Congo, known locally as "huile de m'Pafu".

The question whether the seeds which provide this oil, come from the *Copaifera Demensei* or from distinct species is still unsettled.

The data obtained for the fatty acid content and general characteristics of the oil indicate that it is of distinct commercial value. It may be classed with the non-drying oils, and although attention should be paid to the possible, though improbable, existence of a toxic element, the oil is a homogeneous product, with an agreeable taste, while its somewhat unattractive greenish colour can easily be remedied by the addition of animal charcoal and washed infusorial earth and subsequent filtration.

It is considered that this oil can be utilised advantageously in the manufacture of margarine and the remaining stearin in the soap factories, pharmacies, and in the fabrication of nutritive fats, for which its high fatty acid content makes it very suitable.

The residuary oil could be used for scent-making and as a table oil.

M. L. Y.

870 - **Apparatus and Methods of Analysis for Dairy Industries.** — I FASCIETTI, G., *Apparecchio commerciale per la rapida determinazione del latticello e del grasso nei burri naturali ed artificiali*, in *Annali dell'Istituto sperimentale di Casale in Lodi*, Vol 1, No 2, pp 71-74 Lodi, April 1922 — II DELLA TORRE, G., *Un nuovo termoregolatore elettrico a mercurio*, *Ibidem*, pp 75-77, fig 1 — III VARACOS, G., *Metodo rapido, per la determinazione del grasso nei formaggi*, *Ibidem*, pp 79-81

I. — The apparatus suggested by Prof FASCIETTI for the rapid determination of whey and fats in natural and artificial butters is composed: — of a butyrometer, consisting of two glass tubes of which the lower, with the narrower diameter, contains a scale graduated in fifths of a cubic centimetre, of a centrifuge giving 300-400 revolutions a minute; of a colouring matter (hydroalcoholic solution of methylene blue); of a fluidising liquid (pure amyllic alcohol) and of a water bath; 25 gni. of the sample to be examined is placed in the butyrometer, it is immediately raised to a temperature of 80°-90° in the bath, it is then taken out and one drop of the colouring matter and 5 cubic cm. of the fluidising liquid are added; it is next corked; shaken up; replaced in the bath and after heating for 5 minutes it is centrifuged and with another 5 minutes interval centrifuged for a second time, it is lastly allowed to cool to body temperature, and the volume of the blue column is read; this reading multiplied by 4 gives the percentage of non-fatty matter.

INDUSTRIES  
DEPENDING  
ON ANIMAL  
PRODUCTS

II. — The thermoregulator invented by Dr. DELLA TORRE has been used, with success, for 5 years at the Laboratory of Bacteriology at the "Istituto sperimentale di Caseificio in Lodi". It consists of a glass tube with a bulb at the base, almost completely filled with mercury on which floats a T shaped pin, one of the horizontal arms of which is in contact with mercury fixed on an insulating substance, while the other is in contact with a small platinum plate fixed in the same insulating substance. If the temperature exceeds the desired limit, the mercury expands, the pin rises and moves the other arm from the small platinum plate, thus breaking the circuit. The apparatus is regulated by raising or lowering the part which carries the mercury tube and the plate.

III. — A rapid method for determining the fats in cheeses, invented by Prof. FASCETTI and tested by VARACOS has given, when compared with the SCHMIDT-BONDZYNSKI method, very slightly different results and therefore merits consideration. The process is as follows: — weigh into an Erlenmeyer tube 2.3 gm. of grated cheese; add 10 cubic cm. of sulphuric acid diluted in the same volume of water; place in a bath at a temperature of 80°-85° shaking constantly, after complete solution, decant the liquid into the butyrometer, wash the tube with 5 cubic cm. of dilute sulphuric acid, which is poured into the butyrometer; repeat the washing; add 1 cubic cm. of amyl alcohol; cork; shake; keep for 5 minutes at 65-70°; rotate in the centrifuge for 5 minutes, replace in the bath and read bath at the height of the layer of fatty matter. F. D.

871 — **Correlation between the Quality of Cream and Butter and the Yeasts and Oidia they Contain.** — REDFIELD, H. W. (U. S. Bureau of Chemistry New York City), in *The Journal of Dairy Science*, Vol. V, No. 1, pp. 14-21, bibliography of 11 works, Baltimore, January 1922

This paper gives a description of the technique to be adopted for the determination of yeasts and oidia in cream and butter, and an account of the method used in estimating the correlation between the quality of these products and the number of micro-organisms they contain.

The actual number of bacteria present in freshly made butter is of little importance. The addition of the starter introduces so large a factor of the purely acid type of organism as to dominate the bacterial flora at this stage. The other groups which were only occasionally represented showed a significant number of organisms. Many individuals of the peptonising group occurred only in butter of very poor quality. The number of yeasts and oidia found, however, suggested the possibility of attaching some significance to this determination.

As a rule, low-grade samples show high counts of these micro-organisms, but discrepancies occur frequently enough to indicate that other agents are also capable of causing deterioration in dairy produce.

F. D.

## PLANT DISEASES

### GENERAL INFORMATION

872 — Various measures adopted in France for the Control of the Potato Colorado Beetle (*Leptinotarsa decemlineata*) (1).

I. — Act of the 13th July 1922, supplementing the provisions of the Act of 15th July 1878, regarding measures to be taken for arresting the progress of *Doryphora decemlineata*. — *Journal Officiel de la République française*, Year LIV, No. 189, p. 7371. Paris, July 14 1922.

Art. 1. — The provisions of the Act of July 15, 1878 as to the measures to be taken to arrest the progress of *Doryphora decemlineata* are applicable to cultivated plants other than the potato, when such plants have been, by decree of the Minister of Agriculture, made on the advice of the Comité des Epiphyties, declared liable to attack by *Doryphora*.

Art. 2. — A credit of 500 000 fr. for expenses of all kinds in view of the application of the Act of July 15, 1878 and of the present Act, is opened for the Ministry of Agriculture under the general budget for the year 1922, in addition to the credits granted by the Act of 31 December 1921 and by special Acts.

Art. 3. — When a farmer has made regularly the declaration provided for in Art. 9 of the Act of July 15, 1878, an indemnity may be granted to him in proportion to the portion of the crop attacked which it has been possible to save.

Art. 4. — The Act of 15 July 1878 is modified so far as it contravenes to the present Act.

2. — Decree of July 13, 1922 prohibiting the entry into France and the transit of potatoes and their leaves and refuse coming from the United States and Canada. — *Ibidem*, p. 7418.

Art. 1. — The entry and transit in France of potatoes, and their leaves and refuse coming directly or indirectly from the United States and Canada, countries where the existence of *Doryphora decemlineata* of Colorado has been ascertained, are prohibited. This prohibition also applies to boxes, barrels, sacks and other packing in use or having been used in the transport of the above mentioned produce.

Art. 2. — The prohibition contained in Art. 1. above will be applic-

LEGISLATION  
AND  
ADMINISTRATION  
FOR  
PLANT  
PROTECTION

(1) See also No. 897 of this Review.

able also to consignments of fresh fruit and vegetables other than potatoes and their leaves and refuse, as well as to material used in their transport and packing, when the presence of *Dor decemlineata*, has been ascertained on such consignments

To give effect to this measure, the said consignments will be specifically examined for the purpose on arrival in France

3 — Decree of July 13, 1922 declaring that crops of tomatoes and egg-plants are liable to attack by *Doryphora* — *Ibidem*, p 7418

4 — Decree of July 13 1922 as to measures to be taken to check the progress of *Doryphora*. — *Ibidem*, p 7418

Art 1 — As soon as the appearance of *Doryphora* has been reported in a Department, the Prefet shall immediately appoint with himself as Chairman, a Committee of control composed of the Director of the Agricultural Department, the Director of the Entomological Station for the Department, the Inspector of the Plant Disease Service, the President of the Agricultural Department Office, and 4 leading agriculturists. This Committee will be charged with the duty of giving advice on all measures to be taken in the Department to check the propagation of *Doryphora* and to insure its destruction

Art 2 — An order of the Ministry of Agriculture will fix the limits of the areas attacked and infected by *Doryphora*. Over the whole extent of the Departments in which the areas so defined are situated and of the neighbouring Departments it is incumbent on farmers to burn on the spot immediately, after the harvest, the dead leaves and bad potatoes or the refuse left on the ground

Art 3 — A decree of the Ministry of Agriculture will fix the limits of the control zones to be established around the said attacked or infected areas and the measures to be taken to prevent the propagation of *Doryphora* therein

Art 4 — Preventive treatment with arsenite of lead should be prescribed on crops attacked or infected by *Doryphora* as often as may be necessary during the growth of the plants. When these treatments are considered insufficient, the Prefet, on the motion of the Committee of Control, shall request the Ministry of Agriculture for authority to prescribe the destruction of the crops of potatoes, tomatoes and egg-plants under the conditions fixed by the Acts of July 15, 1878 and July 13, 1922. Trap crops may be prescribed when this procedure is considered likely to prevent the dispersion of the insects and the creation of fresh centres of infection

Art 5 — In the Departments in which are situated the areas attacked or infected by *Doryphora*, the Ministry of Agriculture may place at the disposal of the Director of the Agricultural Department, as a temporary measure, agricultural experts taken from the Service in other

Departments, and in sufficient number to assist him in his duties and to direct on the spot, in accordance with his instructions, the work of control or destruction, to watch for the appearance of the insect in the zones where it is likely to be encountered and to assist the supervision service charged with determining during the winter the centres where the work of control should be started at the beginning of spring

Art 6 — The potatoes, tomatoes and egg plants and their leaves and refuse harvested in the regions declared, by decree of the Minister of Agriculture, to be attacked or infected by *Doryphora*, or in the control zones provided by Art 3 of the present decree, may not be consigned and transported in any manner whatsoever, to places in the uninfected regions

The products above enumerated and harvested in regions other than those indicated in the preceding paragraph may not, if they have been introduced into the said regions, be re-consigned or re-transported, in any manner whatsoever, to places in the uninfected regions

The same prohibitions apply equally to boxes, barrels, sacks and other packings used for the transport of the products indicated above and also to manures, composts, soils or earths

The packing material used in the regions indicated in the first paragraph of the present article for the transport of potatoes, tomatoes and egg-plants from the place of harvesting to the estate of the grower or to market shall be cleansed and disinfected by washing or steeping in boiling water

873 — Ministerial Order of May 27, 1922 announcing the Precautions to be taken against the Propagation of the "Argentine ant" (*Iridomyrmex humilis*), in Italy. — *Gazzetta Ufficiale del Regno d'Italia* (Extraordinary), No 173, p 1752 Rome July 24 1922

In virtue of Articles 2 and 22 of the regulation of March 12 1916 No 723 (1), the "Argentine ant" (*Iridomyrmex humilis* Mayr) (2) has been included in the list — inserted in Art 4 of the Ministerial order of September 28, 1919 (3) — of plant pests of which the Ministry of Agriculture is empowered to decree compulsory destruction

The control of the "Argentine ant" is therefore obligatory in the localities where it has been found and it should be undertaken upon the responsibility and at the charges of the interested parties

The rules and methods of control will be fixed by the Royal Regional Observatories of Plant Diseases

The superintendence of the operations and the execution of the official measures of control will be carried out by the staff of the Observatories, at the cost of offenders or defaulters

(1) Cf — INTERN INST OF AGRIC *Annuaire international de législation agricole*, Vith Year (1916) pp 875-887 Rome 1917 (Ed)

(2) See R June 1920 No 102 (Ed)

(3) See R Oct Dec 1919, No 1260 (Ed)

The Provincial Prefects in whose districts invasion by the "Argentine ant" is notified, shall proceed to the formation of compulsory control Groups in the manner prescribed in Art. 38 of the above mentioned Order.

G. T.

### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN

874 - "Gummosis" in Chestnut Wood. — DUFRENOY, J in *Comptes rendus des séances de la Société de Biologie*, Vol LXXXVI, No. 7, pp. 371-374, figs. 4 Paris, 1922

Gum is deposited in the wood of various plants as the result, for example, of parasitic infection. In the vessels, this gum may come from the degeneration of the thyllae. Woods, like that of the chestnut, which normally form thyllae, exaggerate their formation under parasitic stimulation: some old chestnut trees, suddenly killed by the "maladie de l'encre" have the transparency of their vessels completely obscured by the more or less marked gummosis of the thyllae.

Gum may be deposited in the woody vessels in the absence of thyllae, as in the ligneous cells. A pronounced "gummy" condition may be observed in the wood of the radicles formed by Chestnut trees affected by the "maladie de l'encre" even when these radicles are terminated by luxuriant mycorrhizae.

Gum specially invades the wood laid bare by cauline or radical cankers. This histological gummosis, which produces the gum of wounds, is mainly superficial and local. The gummosis caused by the thyllae is deep and extensive. These two forms of gummosis should be distinguished from that which comes from the gelatination of the middle layer of the membranes.

G. T.

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

#### GENERAL

875 - Bacterial Plant Diseases in the Isle of Luzon in the Philippines. — WELLES, C. G., in *Science*, New Series, Vol LVI, No 1436, p 18 Utica, N Y, July 7, 1922.

It is well known that fungus diseases are numerous and destructive in the Philippines, though up to the present time very few bacterial diseases have been reported so far at any rate as concerns Central and Southern Luzon where scientific investigations have been carried out

Tobacco and other Solanaceous as well as some non-solanaceous plants are attacked by *Bacterium Solanacearum* E. F. S., a micro-organism that has undoubtedly been introduced with certain host plants from temperate regions.

Citrus trees are attacked by *Pseudomonas Citri* Hasse; cabbages by *Ps. campestris* (Pamm.) E. F. S.; beans by *Ps. Phaseoli* E. F. S.; cotton by *Ps. Malvacearum* E. F. S., and parsley by a micro-organism

not hitherto described. These are the only bacterial diseases affecting economic hosts in Luzon so far as present information goes (1).

With the possible exceptions of the bacterial diseases caused by *Ps. Citri* and the hitherto undefined disease of parsley, none of the other diseases and none of their respective hosts are native to the Philippines. There is no doubt that these diseases were imported, and generally with their hosts, from temperate regions. G. T.

876 - Resistance of Wheat × Rye Hybrids to *Fusarium nivale*. — See No. 818 of this Review.

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877 - Resistance of Oats, Varieties Red Rustproof (*Avena sterilis*). Black Tartarian (*A. orientalis*) and their Hybrids to *Ustilago Avenae* and *U. laevis* in the United States. — See No. 819 of this Review.

878 - General Immunity to Diseases of Potatoes in Island of Chiloe, Chili. — See No. 827 of this Review.

879 - *Cassia siamea*, Leguminous Plant used as Green Manure, immune to Diseases and Pests, in Cuba. — See No. 808 of this Review.

880 - Resistance of Sugar Cane to Disease especially to Fiji Disease in the Philippines. — See No. 823 of this Review.

881 - "Pavana" an Italian Grape resistant to Oidium. — See No. 831 of this Review.

882 - Control of Ink Disease and Attacks of the Ascomycete *Endothia parasitica* in the Renovation of Chestnut Woods in France. — See No. 832 of this Review.

MEANS  
OF  
CONTROL

883 - *Helminthosporium* sp. on Rice in Madras. — SUNDARARAMAN, S., in Agricultural Research Institute, Pusa, Bulletin No. 128, pp. 1-7, pl. 4. Calcutta, 1922.

DISEASES  
OF  
VARIOUS CROPS

During the year 1918-19 great damage was done to the rice crop in the delta tracts of Godaveri and Kistria, and a fungoid disease was observed particularly in fields where growth was somewhat poor.

After microscopic examination this disease was traced to a new species of *Helminthosporium* seen on the leaves, the leaf sheaths and the glumes. On the leaves small spots were noticed with a brownish central portion in which smoky black spots appeared visible on both the upper and lower leaf surfaces. These increased in size and frequently united so that the whole area turned brown. Sometimes the entire leaf withered, dried up and turned yellow. Weather conditions play an important rôle in the spread of this disease; heavy and continued rains and cloudy muggy weather favour development. In advanced stages when panicles appeared on plants which showed a severe form of disease, the grains also were effected. Sometimes also the nodes are attacked and

(1) According to ERWIN F. SMITH (*An Introduction to Bacterial Diseases of Plants*, Philadelphia and London, W. B. Saunders Co. 1920, p. 54) some other diseases may be found to occur in the Island. (Ed.)

blackened when the plants approach maturity. Black spots appear on the surface of the glumes and the enclosed grains are found shrivelled up and discoloured.

The fungus was isolated from diseased spots on the leaves and a pure culture obtained. The spores germinate readily in water. A long series of inoculation tests were made with leaves, leaf sheaths and panicles of rice from July 1920 to February 1921. The larger proportion of inoculated plants contracted the disease: spots were formed but these did not develop far. The plants used for control purposes were healthy throughout. The results of the inoculations confirm the field observations made, namely that the fungus in question is, under normal conditions, a weak parasite, and that the disease should not cause serious damage to the crop. G. T.

884 - *Sarna (Oospora Scabies)* on Potatoes on Island of Chiloe (Chili). — See No. 827 of this Review.

885 - Diseases of Cotton. — See Part I and No. 828 of this Review.

886 - *Thielaviopsis paradoxa*, a Hyphomycete injurious to the Coconut Palm in the Presidency of Madras. — SUNDARARAMAN, S., in *Agricultural Research Institute, Pusa, Bulletin* No. 127, pp. 8, pl. 6. Calcutta, 1922.

Many of the coconut palms in the Presidency of Madras are attacked by a malady known under the name of the coconut stem-bleeding disease, of which the first symptom is the oozing of a dark reddish brown fluid from any crack that may be present on the surface of the stem. This exudation turns black as it dries. Below the bleeding portion the tissues decay and turn yellow. In the early stages of the disease, the discoloration or decay of the tissues is localised. In advanced stages, when more than one bleeding patch is seen, a general decay of the internal tissue takes place.

When this point is reached, the palm ceases to bear nuts, the crown dwindles and the tree dies. The effect produced on young trees is worse, especially if the base is attacked. In these cases the outer patches give no indication of the internal decay. The inner soft tissue rots, and a cavity is formed in the central portion of the stem in which a thin yellowish fluid accumulates that gushes out when an incision is made in the cavity. If the decay extends downwards, the tree becomes hollowed out, though there is no external sign of disease. The only thing to be done is to take up the whole tree, carefully removing every bit of the root and burn all on the spot.

The cause of the stem-bleeding disease is the *Dematia Thielaviopsis paradoxa* (de Seynes) von Höhnelt.

Inoculation experiments made in the laboratory at Coimbatore on palms grown in large pots have shown that the fungus can only infect the plants when the stem is injured, or cracks formed on its surface.

The progress of the disease seems to depend upon the age of the host plant. If the infection is localised, the easiest and most effective remedy is the removal of the diseased parts. These should be cut out and



also for greater security some of the healthy tissue, which is easily distinguishable being flesh-coloured, while the diseased tissue is yellowish-brown.

Tar should then be applied to the wound after the wet surface has been dried by scorching either with a lighted torch made of coconut leaves or with a cloth dipped in oil and tied to the end of a stick, in order to insure the proper adherence of the antiseptic. The pieces cut out of the tree should be carefully collected and burnt.

The treatment above described was applied to 100 coconut palms at Sholavandan in the Madura district which were found to be attacked by the disease in September 1918. Two years after treatment the trees were found to be free from disease, quite healthy, in full leaf and bearing heavy bunches of nuts.

G T

887 - *Sclerotinia carunculoides*, n. sp. Discomycete on Mulberry in South Carolina. — SUGLER F. A. and JINKINS A. I. in *Science*, new series, Vol LX, No 1512 pp 353-354. Utica N. Y. G. March 31 1922.

A disease of the cultivated mulberry (*Morus alba*) characterised by the misshapen fruits, has been observed by ORTON and recently by TAUBINHAUS.

The authors have traced the cause of this disease to a new species of *Sclerotinia* known as *Scl. carunculoides*. The fungus was collected in March 1921, at Scianton (S. Carolina).

G T

888 The Mucedin *Monilia cinerea*, found on the Leaves of the Peach Tree in Piedmont, Italy. — CIFERRI R. in *Il Coltratore*, year LXVIII, No 16, pp 501-502. Casale Monferrato. June 10 1921.

In the spring of 1921, drooping leaves of a young peach tree were collected in the Province of Cuneo. The author noticed on them, in addition to small galls due to an unknown agent, the Aphid *Anuraphis persicae* Boyer the Mucedin *Oidium leucoconium* Desm. and the Dematia *Helminthosporium macrocarpum* Grev = *Monilia cinerea* Bon., which in Europe, does not normally live, on the leaves of the host-plant.

G T

## WEEDS AND PARASITIC FLOWERING PLANTS

889 - *Biological Studies on Cuscuta Epithymum* var. *Trifolii*. — CAMPANILI, G., in *Rivista di Biologia*, Vol IV Part 2 pp 175-202 pl 2. Rome, 1922.

Preliminary contribution to the study of the biology of *Cuscuta Epithymum* Murr. var. *Trifolii* Bab.

For his numerous experiments the author used seeds of the parasitic Phanerogam taken from a single lot of Abruzzi lucerne.

The presence of the host-plant (lucerne), in any stage of growth, has no influence on the germination of the parasite which develops even with scanty and intermittent moisture and lives and grows just as well as in a constantly moist environment.

There is a connection between the permanence of the seminal tegument and the comparatively rapid drying of the radical swelling while

the swelling disappears immediately owing to bad hygroscopic conditions the tegument remains longer, protects the extremity of the stalk during the dry period and insures to the plantule a longer life than the unfavourable conditions of the environment would have given.

Shoots of *Cuscuta* detached from the mother plant, apart from their host and under dry conditions, have lived for about a month behaving self destructively and while they dried up at one end, they grew at the other.

Severe attacks by *Cuscuta* were noticed on vigorous hosts as well as on plants whose growth was poor

The behaviour of *C. Epithymum* var. *Trifolii* does not appear to be clearly parasitic except at the time of the formation of its flowering branches; up to this stage, the parasite contents itself with surrounding the host-plant near the base; when the flowering branches have grown they reach the top of the lucerne plants, which they envelop closely and the host rapidly perishes. Disturbing the parasite during the flowering period would therefore prevent the lucerne from exhausting itself and giving poor yield on the resumption of vegetation.

Spring sowing, mixed cropping and generally all factors which help to delay the first cutting of the lucerne until the parasite has already grown its floral branches, are unfavourable to the host-plant, and if the first mowing of the lucerne field is made in the second year, the parasite is quite free to flower, fructify and heavily infect the ground. On the other hand, the factors which shorten the growth period of the lucerne, such as irrigation, influence unfavourably the propagation of the parasite

Tricalcic phosphate and sulphate of potash seem to cause a certain immunity in the host-plant. Organic manuring would have an indifferent action, but as it gives a greater succulence to the tissues of the host, it favours a large development of branches in the parasite

Depth of sowing to avoid infection by *Cuscuta* is not a method of control that is advantageous to the lucerne, because from this point of view the resources of the parasite are much greater than those of the hostplant.

The process of "devitalisation" of the seeds of *Cuscuta* by means of heat seems scarcely to be a practical method, because at the temperatures recommended there is always a diminution in germinative activity and a reduction of germinating power in the lucerne. Heating to a temperature of 65° for 2 hours is the only method which could be of use. As a matter of fact, it is almost innocuous to the germinating power of the lucerne and also as has been ascertained by the previous experiments, this temperature causes a considerable lowering of the germinating power of *C. arvensis* and *C. Trifolii* (1)

To eliminate seeds of *C. Trifolii* from the seed of lucerne, sieves with holes 1.25 mm must always be used.

G. T.

(1) See R. June 1913, No 758 (Ed)

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

890 — **New African Coleoptera.** — BRYANT, G. E., in *Bulletin of Entomological Research*, Vol. XII, Pt. 4, pp. 473-475, figs. 4, London, Feb. 1922

GENERAL

Description of the following species

1) *Crioceris viridissima*, n. sp. injurious to *Asparagus* sp. in various localities in Kenya Colony

2) *Cercyonia citri*, n. sp., widely distributed on the Gold Coast, where it has been observed as seriously attacking young trees of *Citrus* spp.

3) *Argopistes oleae* n. sp., the larvae tunnel out holes in the olive leaves, found in Cape Town

4) *Arg. sexvittatus*, n. sp. found in Cape Province, Natal and in Orange Free State, where holes are observed in leaves of the wild olive

G. T.

891 — **The Cochineal insect *Icerya purchasi* in Provence (1).** — GUILLAUD, E., in *Revue de Viticulture*, Year XXIX, Vol. LVII, No. 1564, pp. 44-45, Paris, July 20, 1922

The Cochineal insect (*Icerya purchasi*) has recently made its appearance at various points in Lower-Provence, and has been specially noticed in the immediate vicinity of Marseilles. Its depredations, which are continually becoming more severe, are at present to be observed on trees of the *Citrus* family, *Acacia*, *Pittosporum*, etc.

It is feared that, in spite of the precautions taken, the Cochineal insect will spread further in the South of France

G. T.

892 — **Organisation of the Control of the Cochineal insect *Icerya purchasi*, in Morocco, in 1921.** — SCHENDLER, A., in *Revue horticole de l'Algérie*, Year XXVI, No. 5, pp. 89, Algiers, May 1922

MEANS  
OF  
CONTROL

The cochineal insect (*Icerya purchasi*) was very probably introduced into Morocco in 1920, with some contaminated plants coming from various parts of Europe. In July 1921, when the Cochineal insect had developed to an alarming extent at Rabat, the Department of Plant Diseases at the Cherifian Scientific Institute immediately organised its control by means of the Lady-bird beetle *Novius cardinalis*.

The Mentone Insectarium, was asked to provide some specimens and a first batch of the pupæ were immediately despatched and reared in the laboratory, beetles and larvæ of the beetle being then distributed among the crops attacked by the Cochineal insect.

The result was quite remarkable and three months later, on an area of about seven hectares, very few *Icerya* were found alive, but on the other hand the plantations were covered with the larvæ of *Novius* which not finding enough cochineal insects to feed on were eating each other.

Fresh centres of *Icerya* having been discovered in the district of Casablanca, attempts at colonisation were started at the end of October 1921, the results are not yet known. At the present time the cochineal insect

(1) See R. Jan. 1922, Nos. 131-132 (Ed.)

has disappeared from the Rabat district so that the Department of Plant Diseases has to obtain from the district of Casablanca the *Icerya* required for feeding a small colony of *Novius* which it is anxious to keep.

The beetle has also been introduced at the Agricultural Institute of Maison-Carrée (Algeria) for distribution wherever the cochineal insect is seen. In Algeria the two centres of infection are at present Bonfarik and Castiglione.

893 — *Leucopis* sp. a destructive Dipteron of *Aphis sorghi* and *A. gossypii*, Injurious respectively to *Sorghum vulgare* and to Cotton in the Anglo-Egyptian Sudan. — COTTAM, R., in *The Entomologist's Monthly Magazine*, Vol. LVIII, No. 694 (3rd Series, Vol. VIII, No. 87) pp. 61-64. London, March 1922.

During November 1914, the larva of a small fly belonging to the genus *Leucopis* was noticed feeding on the dura aphid (*Aphis sorghi* Theob.); the following year from February to April it was found possible to study its habits in the vicinity of Khartoum. At Mogren, a crop of dura (*Sorghum vulgare*) was heavily infested with *A. sorghi* and in company with the larvae of the syrphid *Syrphus aegyptius* Wd. and *Coccinella vicina* Muls. and *C. undecimpunctata* Linn., were large numbers of *Leucopis* sp. The combined efforts of these destructive larvae had a marked effect in checking the spread of the aphid.

In February 1915, a *Leucopis* sp. was further noted as being the only destructive insect attacking the cotton aphid, *A. gossypii* Glover infesting cotton on Tuti Island, near Khartoum North.

Throughout the period from February to April, when the dura crop was cut, all stages of the Dipteron were found on the leaves (described in detail by the author) indicating that breeding was continuous and that generations overlapped. The adults confined in breeding cages paired in the evening and the females commenced egg-laying two days after emerging from the pupae. Oviposition lasts two days and the females then died. Possibly under normal conditions the flies live longer. When laying, the female *Leucopis* hovers over the aphid infested leaves in the same manner as the female syrphid. The eggs are deposited singly on the leaves, close to the colonies of aphides, and are attached in a horizontal position to the leaf surface. On dura leaves the eggs were invariably found on the underside of the leaf but on cotton only on the upperside. They may readily be distinguished from the eggs of *Syrphus aegyptius* and the *Coccinella* spp. From breeding experiments it was found that the average number of eggs laid by a single fly was 34; under natural conditions possibly the number would be higher. The larvae occur among the aphides on which they feed. Under laboratory conditions the life-cycle from egg to adult is completed in 11 days. The entire life-cycle may, however, be considered as 13 days, as the adult female commences egg-laying two days after emergence.

There is no doubt that this small Dipteron constitutes a valuable check on the increase of aphides infesting the two main crops in the Sudan its short life-cycle compensating for the relatively small numbers of egg

produced by each female. The number of eggs found on 12 aphid-infested dura leaves picked at random, varied from 7 to 153 with an average of 93.

A chalcid so far undetermined has been bred from a pupa of the *Leucopis* sp.

G T

894 - **Natural Enemies of Mango Leaf-Hoppers (*Idiocerus* spp.) in India.** — SUBRAMANIAM I. V. in the *Bulletin of Entomological Research* Vol. VII 4th part, pp. 465-467, 2 plates (London Feb. 1917).

*Idiocerus niveosparvus* I. atkinsoni and *I. clypealis*, Rhyncotes belonging to the *Jassidae*, are very common in India where they cause serious damage to the mango crop (*Mangifera indica*).

Studies made at Bangalore (Mysore) have led to the discovery of the following natural enemies of *Idiocerus* spp.

1) *Pipunculus annulihemur* Brun. n. sp., an internal parasite of the three Rhyncotes named *I. atkinsoni* is the species least liable to attack.

2) *Pyrrhoxenus compactus* Picce, an internal parasitic coleopter on the adults of *I. atkinsoni* and *I. clypealis*; in one year 30% of *I. atkinsoni* and 15% of *I. clypealis* were found to be parasitised.

3) *Epipyrops fuliginosa* Tams. n. sp., an external parasitic lepidopter on of the three species of Rhyncotes.

4) A hymenopter on of the Dryinid family, an external parasite of the nymphs of these Rhyncotes.

G T

895 - **Natural Enemies of *Tortrix viridana* in England.** SCOTT H. in *The Entomologist's Monthly Magazine* Vol. LVIII No. (1) (11 Series No. 5) pp. 56-61 (London March 1917).

From four pupae of *Tortrix viridana* collected with a number of others from oak trees in a wood in the Southern part of Cambridgeshire in 1921, 43 chalcidae were obtained; almost all females of the Chalcid *Pteromalus deplanatus* Nees. In two cases 12 emerged from a single pupae.

Amongst the 8 other pupae of *T. viridana* collected at the same time in 1921, the following species of ichneumonidae were bred: *Phaeogenes stimulator* Graenicher (1 male and 5 females), *Pimpla brassicae* Po-dave (1 female), *Labronychus nigricornis* Wesm. (1 male).

Other enemies of *T. viridana* noticed in 1921 were *Calopteryx virgo* (fam. Odonata) at Queen's Bower, New Forest and a Dipter on of the fam. *Empidac* (probably *Empis livida*) at Brockenhurst.

Several occurrences of other enemies (Microlepidoptera) reported elsewhere in England are mentioned, and also the records of large swarms of the Chalcididae *Pt. deplanatus* in England, and of *Stenomalus muscarum* in England and Switzerland.

G T

896 - **Control of Insect Pests of Potato in Island of Chiloe (Chili).** — See No. 87 of this *Review*.

INSECTS, ETC.  
INJURIOUS  
TO  
VARIOUS  
CROPS

897 - The "Colorado Beetle" (*Leptinotarsa decemlineata*), in the Gironde. — FEYTAUD, J., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VIII, No. 25, pp. 705-709. Paris, 12 July 1922.

The presence of the "Colorado Beetle" (*Leptinotarsa decemlineata* Say) has just been reported in France, in the Department of the Gironde. The source, which was without doubt incubating for over a year, was only discovered about the middle of June 1922. Numerous fields had already been invaded throughout almost the whole of the Canton of Blanquefort and of Castelnau in the south.

While the largest invasions recorded in Germany did not exceed three hectares of crops, the present invasion covers more than one hundred according to the statistics of the prefecture of the Gironde; according to the author calculations, the invaded area covers 250 sq. km.

As the insect is polyvorous, it attacks all kinds of Solanaceæ and egg-plants and tomatoes have been destroyed in the neighbourhood of the worst infected potato crops.

In certain districts, the numbers of this Chrysomelid were such that in June all the green parts of entire fields had been destroyed and the beetles had migrated in mass towards the surrounding crops. This occurred at the centre of dispersion, at the original source, at a point where several farmers clearly remember having seen the same insect in the middle of 1921. The flight of the full grown beetles from this point spread the evil in all directions. The predominance of winds from the north and north-west during a fairly long period and the greater abundance of potato crops in the southern part of the canton of Blanquefort, caused the trouble to extend especially in the direction of the communes situated to the west of Bordeaux.

The first measures of control were promptly taken by the prefecture of the Gironde. The application of arsenical treatments began within about a week after the discovery of the pest. The Directorate of the Agricultural Department recommended a formula combining arseniate of lead with Bordeaux mixture the formula which is in common use for the treatment of the vine for the pests known as "altise", "eudémis" and "conchylys". Arseniate of lead was placed free of cost at the disposal of the farmers by the Agricultural Department Office.

As soon as the presence of the insect had been reported, the Entomological Station at Bordeaux took in hand the work of fixing the boundaries of the infected area and giving the Directorate of the Agricultural Department of the province the technical advice required in the circumstances. While waiting for powers to apply radical measures in the worst invaded fields, measures which only the Government could order, the Station advised that arsenical sprayings on the infested fields or on the fields situated within the boundaries of the great centre were not sufficient, but that all the potato fields of the neighbouring communes for a space of at least twenty kilomètres round the centre, should also be treated as a matter of urgency.

In the interval, with the object of improving as far as possible the

process of arsenical spraying, the writer undertook, in collaboration with MONTEIL, assistant at the Entomological Station at Bordeaux, various observations and experiments, which were continued in the laboratory and in the field and of which the following were the first results:—

1) Spraying should be carried out under high pressure and profusely, aiming both at the upper parts and sides of the plants; it is not enough to treat the leaves only, for the stalks and the branches, which are difficult to reach with a superficial spraying, also provide though on a reduced scale, nourishment for the insect. In many fields where the treatment is carried out too quickly, the larvæ find food to live on; the owner, not seeing them any more on the surface of his field, thinks they are dead and is surprised to find them a few days later on fresh shoots, or to see numerous full grown beetles appearing from the ground after pupating.

2) The perfect insects, although generally very voracious, stand fasting much better than the larvæ; hence whenever the food available is, however, slightly displeasing, they leave it, so that the use of arsenical Bordeaux mixture in the sources of invasion may be a means of dispersing the pest; the larvæ also abandon the foliage covered with Bordeaux mixture and seek food on the grass until the growth of fresh unsprayed leaves or the washing of the leaf tops enables them to return to the potato plants. With Bordeaux mixture alone, without addition of arsenical salts, the result obtained is similar.

3) On the other hand, the addition of attractive substances, such as molasses, induces the insects to feed more readily on the poisoned foliage;

4) Comparing the effects of arsenate of lead with those of arsenate of soda, the writer has ascertained that the strength of about 5 ‰ of arsenate of lead obtained by the reaction of anhydrous arsenate of soda and neutral acetate of lead (6 ‰) is much less effective and has a much slower action than the dose of 2 ‰ of anhydrous arsenate of soda alone.

Arsenate of lead at the above strength (corresponding approximately to 1 kg. of powder or paste prepared from commercial arsenate of lead to 1 hl. of spraying liquid) was not sufficiently effective; the poisoning which it produces, even when it is presented in a non-repellant form, is not sufficiently rapid to destroy the older larvæ before pupation, at which period also their appetite is much reduced; the strength should therefore be doubled or should at least amount to 750 gm. per hl., say 1 kg. 100 of commercially prepared powder.

G. T.

898 - The "*Bombyx dispar*" (*Lymantria dispar*) injurious to Apricot Trees, in Vaucluse. — ZACHAREWICZ., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VIII, No. 24, p. 679. Paris, 20 June-5 July 1922.

In the Department of Vaucluse the apricot trees are very seriously damaged by the caterpillar of "*Bombyx dispar*" (*Lymantria dispar* L.) which invades the trees from the month of May and affects the crop by destroying the leaves.

The author recommends as means of control:

- 1) the crushing of the felted masses of eggs on trunks and walls;
- 2) the spraying of the caterpillars with a mixture containing 1 % of arseniate of lead or lime, before the formation of the fruit, and the use of sticky bands or rings of a similar kind.

Many caterpillars can also be destroyed by placing, near the trees attacked, in the month of June, shelter traps formed of simple brush-wood or faggots ; the insects go inside to pupate and the traps are burned before the pupæ hatch out.

G. T.

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INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
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MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

899 - **The Agricultural Problem of the South of Italy and its Dependence on Biological Conditions.** — V RIVERA, in *Atti della Società Agronomica Italiana*, Years II and III, No. 2, pp. 27-73. Rome, June 30, 1922

The author draws attention to the low yield of Italian agriculture using the following figures, which show the average wheat yield in various European countries expressed in quintals per ha.: Italy 11.0; France 13.0; Austria 18.0, Germany 20.0; Switzerland 20.0; Holland 24.0; Ireland 25.0; Belgium 25.0, Denmark 31.7

The problem of the low wheat yield of Italy has been treated from various points of view. Some believe that the progressive tendency which distinguishes agriculture in Northern and Central Europe, would if applied to Italy, cause field crops to flourish, even in the least productive part of the country; others including farmers, University professors and men of science, believe that owing to climatic and social conditions such crops are not really suitable for the South of Italy and that the growth of productive trees which suffer little from the effects of drought, should rather be developed.

The author has studied the problem of the crop returns in the South of Italy from the agronomic and economic points of view. During the 5-year period from 1909-1913, the yield fell to 9.59 qs. in Apulia, 8.3 qx. in Sicily and 7.1 qs. in Calabria, and never exceeded 20 qs. per ha. even in the best years.

From information collected in the district of Andria, the author has ascertained that the total profits from wheat are 300 to 400 lire per ha.,

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

from oats 100 lire and from barley 50 to 100 lire, while beans show no profit at all.

The vine yields on an average 75 qs. of grapes per ha. giving a return of 1000 to 1500 lire; cereals show a return of 200 lire. The olive alone can be cultivated with an absolute certainty of profit. The cultivation of mustard is being extended with satisfactory results.

In order to ascertain the reasons for these facts the author has carried on experimental research for 3 years at San Sisto, near Aquila, on the crops mostly grown in the district, where he has grown in the open field and by the most improved methods beans, lentils, wheat, maize, potatoes and the castor-oil plant. Organic fertilisers (manure) and super-phosphate have given very good results with crops carried in April and May, but leguminous plants and cereals cropped in June and July yielded no profits, for they suffered from drought during the transition from Spring to Summer.

An analysis of the results shows that crop growing was disastrous from the economic point of view as regards all the trials made, with the exception of that of wheat. The greatest loss was on the castor oil plant for which it averaged, for the three years, 620 lire per ha.; then follow, in decreasing progression, lentils with a loss of 227 lire, potatoes 178 lire, beans 85 lire, maize 75 lire; wheat on the other hand showed a profit of 175 lire 60. For this reason the peasants of Central and Southern Italy prefer to grow wheat.

The inferiority of the soil in the South of Italy depends on causes which it is difficult to rectify by means of improved methods and intensive culture. These causes are: the lack of water during the most important period of plant-life and the high temperature during certain hours of the day, which causes the closing of the stomata and consequently prevents assimilation; the luminosity of certain soils adds to the trouble by its injurious effect on the photosynthesis. The cultural factors are: bad tillage, excess of moisture in the initial stage of plant growth, etc. A comparison between the north and south of Italy shows that in the former there is an increase in the quantity of water and the height of the temperature from January to July, whereas in the latter, the water diminishes as soon as the temperature rises.

The propaganda in favour of the use of fertilisers in the dry districts of the south is considered untimely by the author as the fertilisers deprive the plants of their power of resistance to drought.

The author concludes by stating that the causes of the low agronomic and economic returns in the South of Italy are mostly due to climatic and biological conditions and that poor methods of cultivation have only a secondary influence. The measures adopted to remedy the evil should be based on the biological factors and the individual requirements of each plant as regards climate and exposure should be taken into account.

R. P

900 - **The Fertility of the Soils in Greece.** — BOUYOUKOS, G. (Michigan Agricultural Experiment Station), in *Soil Science*, Vol. 13, No. 2, pp. 63-72. Baltimore, Feb. 1922.

At the request of the Greek Government, the late C. G. HOPKINS, with the writer as his assistant, was sent to Greece by the American Red Cross and the War Board to investigate the soil productivity. Though the enquiry lasted only one year it led to decidedly interesting results. HOPKINS drew up a report which was addressed to the Government and the farmers of Greece. It was couched in a rather simple and popular form, and has not yet been translated into English. Had Dr. HOPKINS lived, he would no doubt have prepared a more scientific report. Yielding to the request of men of science, the author has now attempted to supply the deficiency.

Soil production in Greece is very low. For instance, the average wheat yield is only about 11 bushels to the acre, and this is produced only once in two years, or even in three years and during the interval the land is left fallow. The yield of all grain crops is low. As to legumes, only a few kinds are grown for human consumption. The culture of leguminous plants is practically unknown. The writer does not treat of fruit-growing.

The causes of the low yield are numerous. It is partly due to the use of unselected seed, to the high temperature and above all to the drought towards the end of Spring and during the Summer, which, in the absence of irrigation, renders cultivation difficult, but the chief cause is the sterility of the soil. The farmers do almost nothing to render the soil fertile. The majority of them have never used commercial fertilisers; farm manure is quite scarce, because in Greece the chief livestock consists almost entirely of sheep and goats which graze nearly the whole year on the mountains; the advantage of alternating cereals with legumes is unknown; the few leguminous crops grown are pulled up by the roots, so that the soil derives no benefit from the nitrogen. While lying fallow, there is no shortage of wild legumes, which are for the most part grazed by the flocks; the soils probably receive a little nitrogen from these plants.

Greece is a very mountainous country, but nearly all the cultivated land is of fine texture. It is rich in clay and silt, even when very stony. The chemical composition of the soil varies greatly, as is seen from about a hundred analyses given by the writer. For instance, for each ha. containing 2 250 000 kg. of soil, the nitrogen varies between 1687 and 1625 kg., the phosphorus between 236 and 13 185 kg., potassium between 2800 and 72 551 kg. and magnesium between 2000 and 51 918 kg.; the calcium variations are still greater, being 3200 to 140 000 kg., especially in the case of limestone, of which there is generally an excess, though sometimes it is entirely absent. As regards the soils deficient in lime some are acid, but these are comparatively rare. With very few exceptions, potassium, is generally abundant but phosphorus and nitrogen are often deficient.

The great influence of the chemical composition of the soil in Greece on its fertility is confirmed by two series of experiments made during the short time Dr. HOPKINS was able to work. Melilot was cultivated in 38 earthenware jars, and it was seen that phosphorus produced a marked

increase in yield. Thus in limestone soil the yield rose on an average from 32 to 105 gm. by the mere addition of acid phosphate. The melilot was afterwards partially dried and mixed with the soil in which the roots had been left. The result of planting millet in this was a much larger growth than that in the control. Eight field tests were also made in different parts of Greece. The writer only gives the results of two, in acid soils, namely, those to which limestone was applied at the rate of about 25 tons to the ha. and acid phosphate at the rate of about 5 qx. This caused a great increase in yield, which in one case rose from 150 kg. to about 3,100 kg. or twenty times more. The addition of lime or phosphate was much less beneficial. In general, during the course of this inspection in Greece, it was seen that the soils respond readily to fertilisers, especially to those containing nitrogen and phosphorus, and, if acid, of limestone. L. V.

901 - **Agriculture in the State of Parana (Brazil).** — MUNHOZ DA ROCA. *Mensagem dirigida ao Congresso Legislativo pelo Dr. Cactano MUNHOZ DA ROCA, Presidente do Estado, ao instalar-se a 2ª Sessão da 15ª Legislatura*, p. 106. Curityba, February 1, 1912 (1).

The importance of agricultural production in the national economy of the State of Parana is shown by the value of the exports during the financial year 1919-1920, dealt with in this "Message". The value of the exports taken as a whole reached the figure of 638 550 88 milreis of which 34 876 000 relate to maté — 11 991 500 to timber — 5 450 400 to live stock — 609 888 to coffee — 4 927 300 to miscellaneous produce. Maté thus represents more than 60 per cent of the State revenues.

With a view to placing on a sound basis and developing the two principal agricultural sources of wealth of the country, by the Decree No. 1201 of November 17, 1920, the period in which the picking of maté is allowed is confined to the season from May to October, and the analysis of the trade product is made obligatory under the guarantee seal established by Law No. 1956 of March 23, 1920: Law No. 1986 of April 5, 1920 fixed the times during which the felling of timber is permitted, and makes obligatory the reafforesting of clearings, leaving to the person concerned the choice of trees to be planted.

The State supports the following institutions for agricultural instruction and experiment: "Escola agronomica" of Curityba founded by Law No. 1788 of April 5, 1918, which had in 1920 93 students: "Instituto Bercachery" devoted to experimental plantations with the object of making a study of the crops best suited to the climatic and general local conditions of the State: this Institute has been attached to the "Escola agronomica" and selection experiments, trials of fertilisers, practice in agricultural work, manual and with machinery, are carried on there:— "Campo do Portao" an experimental farm also attached to the "Escola agronomica" — "patronato agricolo" an orphanage which prepares pupils for agricultural work and a staff of inspectors of agriculture. An experimental station for seed production is just about to be founded.

(1) For other information as to the agriculture of the various Brazilian States, see *R.* July 1922, No. 681 and the bibliographical note. (*N. d. R.*)



Subsidized colonization has come to an end, but the State encourages colonization either by giving facilities to the colonist for the acquisition of land vested in the Federal Government or in private undertakings, or by assisting communes to do the same, or finally by acquiring land on its own account for assignment to colonists. Law No. 1642 of 1916 fixes the conditions under which land can be granted to private persons: in application of this law 1 100 000 hectares of land have already been distributed in Parana, the greater part to Brazilian colonists, natives of Rio Grande do Sul.

F. D.

902 - **Agriculture in Martinique.** — *Bulletin Agricole de la Martinique, Revue trimestrielle publiée par le Service de l'Agriculture, Year IV, No. 22, pp. 40. Fort-de-France, 1922.*

*Department of Agriculture and Forestry: organisation and working.* — The inauguration of the Department of Agriculture coincides with the establishment of the trial plots at Tracée, Tivoli and at Prefontaine and of an agricultural laboratory; these were established by the law of March 11, 1904. The law of January 20, 1909 set out the duties of the department and the law of April 26, 1909 instituted new trial plots as well as agricultural instruction.

As at present organised, the essential aim of the department of Agriculture is on the one hand to improve the crop yield and the industrial output of sugar cane by the application of improved methods, and on the other to encourage the development of the so-called secondary crops, so as to safeguard the colony against the dangers of a single cultivation. At the present time it consists of two separate sections: that of agriculture properly so-called and the forestry section.

The functions of the agricultural section and its programme of action may be summarised as follows:

1. *Scientific and experimental research:*

a) in the laboratories of agricultural chemistry and technology, entomology and phytopathology.

b) in the nursery gardens and experimental plots, the subjects treated being sugar-cane and the so-called secondary crops: cacao, coffee, citrus fruits, etc.

2. *Agricultural instruction and propaganda:*

a) agricultural instruction in the primary schools, in the training colleges, in the secondary schools, and in a special school of agriculture;

b) propaganda and information, by means of consultations either through the post or by interviews and publications.

3. *Agricultural improvements and rural engineering* (drafts and plans, inspection of constructional work in progress and maintenance work).

4. *Encouragement of agriculture:*

a) prizes for secondary crops, for agricultural instruction, etc.;

b) payments and subsidies for permanent improvements such as drainage, irrigation, etc.;

c) agricultural shows and competitions;

d) co-operation and agricultural mutual aid through syndicates, co-operative societies, credit corporations, etc.

In regard to the *forestry section*, its functions include :

- 1) the oversight and preservation of the existing forests whether belonging to the State or to private persons ;
- 2) the scientific management of State woods and forests ;
- 3) reafforestation ; regulation of rivers and waterfalls.

The budget of 1922 includes : for administration and laboratories 48 000 francs ; trial plots 103 600 francs ; forests 60 600 francs. It includes further a credit of 50 000 francs for reafforestation and another credit of 30 000 francs for the encouragement of agriculture.

The essential business of the trial plots is to prepare and distribute free of charge to agriculturists who make application, seedlings, etc. of the best kinds of useful plants, sugar cane excepted. During the decade 1912 to 1921, more than 1 100 000 seedlings were distributed, of which 177 000 in round numbers were coffee plants, 64 000 cacao, 476 000 citrus fruits, 294 000 tobacco plants, and 183 000 miscellaneous.

The forests cover about 20 000 hectares, of which 7 000 belong to the estates of the Colony and 13 000 to private persons. The annual coefficient of increase may be estimated at from 5 to 6 cubic metres, representing an annual production of at least 100 000 cubic metres, that is to say double the consumption of the island.

*Sugar cane cultivation and subsidiary industries.* — Out of a total area of about 98 000 hectares, of which 76 000 are volcanic lands in the north and 22 000 are alluvial lands, the sugar cane occupies nearly 27 000 hectares, of which only 18 000 are cut each year, the remainder being partly under rotation (fallow, green manuring or pasturage) and partly planted with young canes. All the land suitable for the cultivation of cane is already planted, so that there seems no likelihood of any increase in the area covered by this crop. On the other hand it is possible to increase production by improving the methods of cultivation and of manufacture ; by these means the present production might be raised from 30 000 to 100 000 tons per annum.

At one time the yellow cane of Otaïiti or the Bourbon were almost exclusively cultivated, but for thirty years past, owing to the fact that the older varieties have undergone degeneration, numerous varieties obtained from seedlings have been introduced from British Guiana, Demerara and Barbadoes. On the Congo, these varieties also degenerate, those from Barbados sooner than those from Demerara. As a general rule it may be said that their introduction is useful, as tending to preserve, if not to develop the cultivation of the sugar cane

The first sugar harvest takes place 18 months after plantation : the second (first suckers) 12 or 14 months later ; the third (second crop of suckers) is left on the ground and used for pasturage for three or four years.

There are in Martinique at the present time 15 sugar factories. The sugar of the first flow reaches 98.8 degrees of polarisation : few sugar

factories have an output showing a lower polarisation than 97. The second flow polarises at 95 to 97 on an average. Local consumption absorbs about a thousand tons per annum: the remainder (30 000 to 40 000 tons of all types) is exported to France.

The cane-trash is used for fuel: one ton of cane supplies 200 kg., with 5 % of humidity, equivalent as fuel to at least 50 kg. of coal. The scum of the boiling is mixed with chopped straw and used as forage: 10 kg. is obtained per ton of sugar-cane. The molasses is used in the manufacture of rum. Generally it contains 54 to 58 % of absolute saccharine and from 20 to 30 % of directly reducing sugars as against 30 to 40 % of saccharose. The average density is 1.40 and the theoretical yield is 90 l. of rum at 55 degrees per hl.: the actual yield is 75 to 80 % corresponding on an average to 24 l. of rum per ton of sugar cane.

*Secondary crops and subsidiary industries.* — The most important of these is the cultivation of the cacao-tree which occupies about 1 500 hectares in the north of the island. During the five years 1917-21, an average of 400 000 tons of cacao beans has been annually exported against an average of 500 000 tons during the pre-war period.

The chief varieties cultivated are: Criollo, Venezuela, Calabacillo. The principal shelter-trees are: Glyricidia, Samana (*Pythecolobium Saman*). The annual production is about one kg. of beans per tree and in the better cultivated plantations as much as two kg.

There are three chocolate factories which can turn out 1 200 kg. of tablet chocolate per day, and two cocoa powder factories which can together work up 2 000 kg. of cocoa beans a day.

Coffee which was lately cultivated on a large scale, has been seriously attacked by two parasites: the eel worm (*Heterodera radiculicola*) and the butterfly known by the name of *Cemiosoma coffeola*, the larva of which eats the leaves. For some years past the replanting of the plantations with *Coffea liberica* and *Coffea robusta* has been proceeding.

The shade trees most usually planted are the sweet tamarind (*Inga edulis*) the samana and the glyciridia.

Since 1910 the cultivation of the lime-tree has been much developed, especially that of the *Citrus medica* var. *acida* which is used both for direct consumption, and for the preparation of the concentrated juice, and of citrate of lime, which is manufactured in four factories in the island, and also of the essence extracted from the rind.

Tobacco grows wild in Martinique as in all tropical America. The "Grand Martinique" must be an original variety. This was formerly a flourishing crop and is in a fair way to revival: the quality of the product is very good.

Cotton (*Gossypium arborescens*) is wild or cultivated all over the island, but cultivation properly so-called is very limited. It formerly covered thousands of hectares. The long staple variety (*Sea Island*) is the best suited to the island.

There is no textile industry in Martinique. Nearly all the natives make rope with aloe fibres, called "ox tongues" (*Agave rigida*), with manilla hemp or banana fibre (*Musa textilis*), with the bark of different plants, parti-

cularly the malvaceae of the genera *pavonia* and *pariptium* and of the boragaceae of the genus *cordia* called by the Martinique planters "mahot".

For making baskets, etc. the "aroua" (*Marantia juncea*) is used; for making fishing tackle bamboo; for ordinary hats, the leaves of certain palms, especially "latanier" (*Thrinax barbadensis*).

Vanilla grows well in Martinique, but its cultivation has been neglected to such a degree that in several years the production was not enough for local requirements. The average annual export during the last ten years was 1900 kg. The *Vanilla aromatica*, which is of little commercial value, grows wild: the two following kinds are cultivated: "Mexican vanilla" (*V. planifolia*) and the "vanillon" (*V. claviculata*).

There are unimportant exports of nutmeg and cinnamon and ginger; pepper and cloves are produced in scarcely sufficient quantities for local consumption.

*Stock breeding.* — This is quite inadequate for the requirements of the local food supply, the provision of draught animals and the supply of manure. There are approximately: 10 000 horses; 25 to 30 000 cattle; 30 000 sheep and goats and 20 000 swine. There are 12 000 hectares of meadow land and grass land in the island to which must be added 6 to 7 000 hectares of fallow, so that the effective area available at present might be doubled.

The creole horses are small (1<sup>m</sup>.30-1<sup>m</sup>.40) easily handled and hardy. They feed on Para grass (*Panicum molle*) or Guinea grass (*Panicum maximum*), green sugar cane tops at the time of cutting, cane scum, dry straw chopped and mixed with molasses.

There is no horse breeding properly so-called.

There are a fair number of mules: those of native breed are small (about 1<sup>m</sup>.30), while those which are imported from Porto-Rico or the United States are larger and stronger, but need more food.

The stock of cattle is made up of animals of small size originating in the crossing of the various breeds that have been successively imported into the colony. There are no special breeds of butchers' beasts or dairy cattle. The better cows give at most 4 to 5 litres of milk. The yield of butchers' meat is from 40 to 60 % and the meat is of ordinary quality.

The sheep own their origin to the crossing of the South American breeds with those coming from Senegal.

The swine are reared round the dwellings: they recall the Iberian breed.

F. D.

903 - **Agricultural Implements in Syria and Lebanon.** — *Service de l'Agriculture du Haut-Commissariat de la République Française en Syrie et au Liban. Enquête sur le matériel agricole se trouvant en Syrie à la date du 31 décembre 1921* (1), pp. 1-11. Beyrouth, Jan. 21, 1922.

Included is a table giving statistics for each kind of horse-ploughs, threshing and winnowing machines, implements, motor driven machines,

(1) Documents in support presented by the Temporary High Commissioner of the French Republic in Syria and Lebanon.

machines used in agricultural industries, etc.), of the agricultural implements in Syria and Lebanon on December 31, 1922. The report also shows: the type of the different machines, the districts possessing the greater number, the country from which sent if imported, the causes of their success or failure, improvements made or to be made in the construction or selection of types, where and by whom the trade in agricultural machinery is carried on and the terms of payment. The districts most adapted to the use of agricultural implements are also enumerated.

There are no contractors for ploughing or threshing anywhere in Syria. In the Province of Damascus some tractor owners let their machines out on hire to their neighbours. In the Province of Aleppo, in the Sanjak of Alexandretta and in the territory of the Alanites, the Agricultural Service has carried out contract work, allowed farmers the free use of various kinds of machines and in some cases has lent ploughs.

These advances have been well received.

The causes which operate against the use of agricultural implements in Syria are the following: the farmer supplies the material for the crops and when they are ready for the harvest the landlord advances the money necessary to carry out the work, the sum being calculated on the prospective yield. These advances are made at a very high rate of interest and after repayment there is a very small margin of profit; the farmer has no capital; there is a lack of practical knowledge and distrust on the part of the farmer and owner of every innovation; the implements imported, especially ploughs, mowers and reaper-binders are unsuitable for local conditions; lack of initiative on the part of the large landowners; the poor and weak condition of the draught animals; the lack of repair sheds and depôts for spare parts.

The following are recognised in this report as essential factors in the extended use of agricultural machinery: a change in the methods of farming, the opening of a credit fund by the Department of Agriculture, the spread of technical and practical instruction in agriculture, the extension of the knowledge of the results obtained by the use of agricultural machinery, the development of the breeding of draught animals, the adaptation of machinery, the building of repair sheds and depôts for spare parts and the establishment of companies for carrying out agricultural work on contract terms.

F. S

904 - **The Teaching of Soil Bacteriology.** — BROWN, P. F. (Professor of Bacteriology, Iowa State College, Ames), in *Journal of the American Society of Agronomy*, Vol. 13, No. 8, pp. 323-329. Washington, Jan., 1922.

AGRICULTURAL  
EDUCATION

It has been said that soil science is the basis of agriculture. It covers an extensive field and the fact that it is now taught in several courses is not only through pedantry but also because it has been found necessary in order to impart a thorough knowledge of the subject.

From experience gained at Iowa State College it may be taught with advantage in four courses, of which one is general and introductory, one final and applied and two intermediary on fertility (especially as connected with chemistry) and on bacteriology.

Soil bacteriology is a branch which has only recently been differentiated from agricultural bacteriology. In the *curriculum* of nearly all agricultural schools it has not yet been treated as an independent branch, but it is nevertheless of growing importance. At present soil bacteriology can no longer remain an accessory, almost fortuitous subject, included in agricultural bacteriology.

Up to the present time there is still a lack of special works on soil bacteriology ; instruction should therefore be oral, and enlivened by discussion and written work, which greatly tend to enlighten the mind.

Certain subjects, such as nitrogen fixation, nitrification, the carbon cycle, the sulphur cycle, the phosphorus problem, the part played by fungi, the occurrence of protozoa etc., should be emphasized particularly ; others of minor importance, such as denitrification, should be minimized. The subject matter should not be too technical and intricate, but simple and concrete and directed towards enlightenment in the practice of agriculture, tillage, manuring, liming, drainage etc. It should arouse the attention and keep up the interest of the pupils ; and should be completed by demonstration and laboratory experiments.

L. V.

905 - **Agricultural Instruction in Belgium.** — MINISTÈRE DE L'AGRICULTURE, *Situation de l'Enseignement Agricole, Rapport triennal avec Annexes, présenté aux Chambres Législatives par M. le Ministre de l'Agriculture, Years 1918, 1919, 1920, pp. XXIV + 219. Brussels, 1920 (1).*

Except for some schools, where the apparatus was completely destroyed in the war, courses and demonstrations have been resumed everywhere. Under the impulse given by the Administration, the subsidised schools are acting as far as possible on the new requirements created by the war : they are improving their methods, revising their syllabuses and completing their schemes.

*Chief Council for improvement of agricultural and horticultural instruction.* — This Council which was created by a Royal decree of 31 March 1919, and is composed of the most outstanding personalities of the educational and agricultural world, has brought to the task of the restoration of agricultural instruction in Belgium the fruits of a most careful collaboration. The Council deliberates on all questions and subjects relating to the progress of agricultural and horticultural instruction. It includes 12 members with the right to vote and a certain number with the right of speaking but not of voting. It consists of five sections : 1) Higher agricultural instruction ; 2) Ordinary agricultural instruction ; 3. Popular agricultural instruction ; 4) Ordinary and popular horticultural instruction ; 5) Farmhouse management.

*Higher agricultural instruction.* — Important modifications have been introduced into the organisation of higher agricultural instruction. The law of November 15, 1919, relating to agricultural instruction, has replaced that of April 4, 1890, and has made possible the creation of a Flemish

(1) See R. July-August 1920, No. 713. (Ed.)

**Agricultural Institute.** A new Royal decree of April, 8 1920, regulates the conditions of admission to the Higher Institutes of Agriculture and the ratification of the diplomas issued by these institutions. This decree established diplomas of "Licenciate in Agronomic sciences", to be given after two years study: it extends to 4 years the period of study for obtaining the diploma of "agricultural engineer" namely two years of general studies leading to the diploma of "candidate for agricultural engineering" and two years of specialisation leading to the diploma of: agricultural engineer, colonial agricultural engineer, engineer of Waters and Forests, rural engineer, horticultural engineer, engineer of agricultural industries or engineer, of chemical agriculture.

*State Institute of Agriculture at Gembloux.* — Courses were suspended during the academic year 1917-18. The admission of 200 students since the re-opening speaks well for the reputation of the institution. Changes have successfully been made in the system of farming, and the farm is now chiefly experimental and a demonstration ground.

*State Institute of Agronomy at Ghent.* — The State Institute of Agronomy at Ghent was established by the Royal Decree of May 25, 1920, in application of the law of November 15, 1919. The courses are given in Flemish. The first academic year opened on October 19, 1920 with 20 regular students. The State has acquired a property of 60 hectares, situated at Melde, as an experimental farm annexe to the new Institute.

*Higher Training Institute of Farmhouse Management at Laeken (1).*

*Intermediate Agricultural Instruction.*

*State School of Practical Agriculture at Huy.*

The programmes of work have been thoroughly revised and a year of preparatory studies has been arranged. New courses have been established including agricultural machinery and the Flemish language.

In drawing up programmes, recent advances of science have been kept in mind and practical courses on motorculture have been held.

There are at present 51 students. This figure is a decided advance on those of previous years. Several lectures have been given by members of the staff, with the satisfactory result of making the school better known.

*State aided schools of agriculture.*

*Carlsbourg School of Agriculture.* — The courses have as their special aim the questions of intensive production, motorculture and the improvement of rural life.

*Louvière School of Agriculture (Institute of St. Joseph).*

*Leuze School of Agriculture.* — The syllabus has been completed by lessons on stock breeding and the feeding of cattle. In view of the re-inauguration and reorganisation of stock breeding syndicates special courses have been given on milk analysis.

*Agricultural School departments in receipt of grants.* — These are the following: the intermediate agricultural departments at Aerschot, Avelghe, Brée, Brugelette, Buggenhout, Chimay, Dinant, Ellezelles, Enghien, Fleurus,

(1) See R. Oct. 1921, pp. 1295-97. (Ed.)

Hannut, Hasselt, Opwyck, Saint-Trond, Schadeck-Attert, Sotteghem, Thielt, Thuin, Tirlemont (Collège Notre-Dame), Tirlemont (Ecole Provinciale), Tongres, Virton, Visé, Waremmé, Wavre (Institut Saint Jean-Baptiste), Wavre (Ecole provinciale).

*Grant-aided Private Schools and Departments of Farmhouse Management.* — These schools are in a very satisfactory condition. An agricultural education given to girls side by side with a general education is much appreciated by those concerned, in spite of the marked tendency after the war to leave the country districts in search of an intellectual culture alien to the agricultural sciences.

The Farmhouse Management schools in receipt of grants are the following: farmhouse management school of Bastogne, Berlaer-lez-Lierre, Bouchout, Brugelette, Celles (Hainaut), Ciney, Cortemarck, Herve, the higher agricultural school for girls at Héverlé, the farmhouse management school at Locre, Marchet-les-Dames, Maulde, Overysse, s' Gravenwezel, Tessengerloo, Virton, Wavre Notre-Dame.

The Farmhouse Management sections in receipt of grants are the following: the farmhouse management section of Balegem, Brugelette, Champlon, Jodoigne, Ressegem, Vezon, Waremmé and Zeelhem.

*Courses of Agronomy in the State higher and Intermediate Schools.* — These courses were suspended in 1918, and resumed in the following year.

*Courses of Agronomy in the Intermediate Private Schools.* — 52 courses of agronomy have been organised in these institutions during the last three years.

*Elementary agricultural instruction.*

*Technical agricultural departments for boys.*

These departments are local and usually attached to the rural primary schools, or are travelling schools. The form of agricultural instruction followed in these winter courses is well adapted to the routine of agricultural life. Several new sections came into being during the three years under consideration, though on the other hand several ceased to exist.

*Schools of agricultural machinery.* — These with their highly specialised programme are much appreciated.

*Travelling Farmhouse management schools.* — After the armistice the schools restarted their activities to the great advantage of the rural population who much appreciate the instruction given. Five new schools, at Beirendrecht, Heyst-op-den Berg, Campenhout, Clytte (Reninghelst) and Yvoir, were established in 1919.

*Popular agricultural instruction.*

*Lectures given by the State Agricultural Experts.*

These lectures given on subjects of general interest to the cultivators of the district are always much enjoyed by their many listeners. The experts find these gatherings an opportunity of becoming acquainted with the farmers and of establishing valuable relationships with them.

*Agricultural lectures to adults.*

Beginning from the armistice these lectures are intended to draw the attention of cultivators to the means that can be employed to bring



about an immediate increase in agricultural production. In this connection peripatetic lectures were instituted in 1920 to introduce farmers to the method of sorting potatoes in sizes. There is at present a tendency to replace adult courses by these more detailed courses providing a more thorough and methodical instruction.

*Lectures for farmers' wives.*

These are a much appreciated type of agricultural instruction and also one of the most valuable.

*Courses in poultry rearing.*

These courses are well attended not only by amateurs but by farmers who are trying to improve the conditions of poultry farming.

*Bee-keeping courses.*

Courses in bee-keeping organized on the initiative of the bee-keeping federations are attended by bee-keepers anxious to learn and to improve their methods of management.

*Courses in agronomy for soldiers.*

In 1920 the Department of Agriculture instituted experimentally, courses for soldiers in barracks.

*Special lectures.*

A large number of special lectures have been given by the agricultural federations that are independently managed but under the inspection of State experts. These lectures are intended to give a fresh impetus to agricultural associations and to keep their members in touch with advances in agricultural science.

*Demonstrations in the scientific feeding of stock and in experimental plots.*

Whereas Belgium used to consume the largest quantity of fertilisers per unit of area, there has been a considerable falling off at the present time. On the other hand it has been impossible to renew sowing at the proper time and hence there has been deterioration in this respect also. Lastly prepared cattle foods have been used on a reduced scale only on account of their scarcity and high price. With the object of remedying these conditions and of bringing about an increase of agricultural production, the Department of Agriculture has instructed the State experts in agronomy to undertake the following experiments :

- 1) to show that in spite of their high prices the use of chemical manures is still profitable ;
- 2) to examine the question of the most economical fertilisers in the present circumstances ;
- 3) to spread information about fertilisers recently produced in any part of the country or as to possible sources of such production ;
- 4) to distribute good kinds of seeds ;
- 5) to prove the advantageous effect on milk-yield of an increase of protein in the diet.

Some of the experiments undertaken are given below .

a) trials on a uniform basis throughout the country dealing with the different nitrate manures ; the different phosphatic manures ;

b) trials on a regional basis of selected varieties of wheat, barley and oats, supplied by the Department, besides one or more local varieties supplied by the experimenter ;

c) trials, according to plans laid down by the State experts, bearing on the selection of seeds, especially potatoes, and on the effect of a second tillage on cereals ;

d) Experimentation on cattle-feeding.

*Department of Agricultural Information.*

The agronomic station at Gembloux consists at the present time of the station for agricultural chemistry and physics ; the dairy station ; the phytopathological station ; the rural engineering station ; the entomological station ; experiment station for seed improvement ; the forestry station.

*Inspection of agricultural instruction.*

The committee for administration and supervision, the inspectors of agriculture, the inspectresses of farmhouse management, and the State Agricultural Experts have had the oversight of the working of agricultural education in varying degrees. The reports prove that on the whole the different institutions fulfil their objects.

*Schools of horticulture.* — The State schools are: the Ghent school of horticulture and the school of horticulture at Vilvorde.

The schools subsidized by the State are those of Carlsbourg, Liège, Mons and Tournai.

*Temporary schools of horticulture.* -- In most of the centres of professional horticulture temporary schools were established with the object of making it possible for practical gardeners to profit by the practice in other parts of the country, and to apply the results of science to their own work.

There were also temporary schools where it seemed likely that market gardening or orchard work could be started. The number of schools amounted to 45 by the end of the period.

There are also courses on fruit growing and market gardening and lectures on fruit growing, market gardening and horticulture. F. S.

The writer observes that the "statistical" method introduced into physics and chemistry by MAXWELL by the study of the theory of heat, has been applied to industry, in which it has led, among other things, to manufacture in bulk and series ; its application has also been very successful in biology and agronomy. By means of statistical classification, it has been possible to make selection chronologically but spatially after a few years only, of the best types of plants and of the methods of fertilisation best adapted to soils, various cultures, etc. A statistical department has already been instituted in Egypt for plant selection (cotton, maize, etc.). The famous station at Rothamsted has

also founded a statistical laboratory. In Germany the adoption of the new method has been retarded owing to the fact that workers are still too much under the influence of the old experimental empiricism. In other countries, such as France, Spain, etc., scientists are still less up to date in the matter of agronomic research than in Italy, where each of the agricultural experiments carried out up to the present can bear critical examination.

In order that the data collected may be arranged mathematically, they should be sufficiently homogeneous, definite and numerous, hence the necessity of coming to an agreement with regard to publishing uniform standards for experimental work and observation on broad lines. The writer suggests that the " *Società Agronomica Italiana* " should take up the problem, entrusting the solution to a competent committee composed of agronomists, biologists and mathematicians. The Society, it should be noted, has already taken steps in this direction by organising collective research.

To carry out this aim considerable financial resources are required. The author calls the attention of the State, the local consumers' cooperative societies, agricultural institutions and farmers to the fact that the period of unaided science, is drawing to a close. To-day research-work needs definite financial support; the funds are used for cost of material, implements, staff, travelling for first hand investigate and controls. The author criticises the increase of stations poorly equipped and over specialised, such for instance as that for maize-culture; it would be better to limit the number but to provide a better equipment, and also substations for each particular crop and specialists.

The author proposes to the Society the following programme of research-work: 1) a soil map of Italy; 2) the nitrifying power and fertility of Italian soils; 3) comparative tests as to the effects of liming according to soils and cultures; 4) research and comparative tests on the most efficacious use of stable manure and organic matter; 5) research and comparative tests on the efficacy of phosphates and other phosphatic fertilisers; 6) the possible influence of superphosphates on the oligodynamic elements: aluminium, iron, arsenic, etc.; 7) research and comparative tests on the efficacy of new nitrogenous fertilisers; 8) research as to the most economic use of water for irrigation; 9) systematic research on "dry farming"; 10) study of the crop rotations best adapted to the different regions of Italy; 11) registration of the local species of the chief plants cultivated in Italy; 12) registration of the principal local breeds of cattle in Italy; 13) maintenance of fish ponds for intensive pisciculture; 14) revision of the methods of analysis for products useful for agriculture; 15) unification and standardisation of the methods used in agricultural experiments; 16) revision of the principles of agricultural statistics in Italy. After research on these and similar questions has been organised and successfully carried out during the required period of years, means should be devised for applying the results obtained to the improvement of agriculture.

R. P.

907 - **The Institute of Agronomic Research, France.** — BRUNO, A. (Inspecteur général des Stations Agronomiques de France), in *Chimie et Industrie*, Vol. 7, No. 6, pp. 1222-1224. Paris, June 1922.

On the July 30, 1922 a bill was presented in the Lower French Chamber for the foundation of an Institute for the development, promotion, organisation and coordination of scientific research in agriculture.

Before this bill was discussed, art. 70 of the Financial Law of April 30, 1921, was approved in the following form :

An Office for the development of Scientific Research as applied to Agriculture with the object of stimulating and intensifying agricultural production shall be established at the Ministry of Agriculture. This organisation, called "The Institute of Agronomic Research," shall be vested with independent powers in the administration of its civil and financial affairs. Its organisation, the conditions, under which it will work and the methods to be followed will be determined by a decree drawn up by the Ministries of Agriculture and Finance.

At the same time two millions were voted in Parliament for scientific research, and the Institute was founded with the following statutory orders, published in the *Journal Officiel* of Dec. 28, 1921.

To control, under the direction of the Ministry of Agriculture, the stations and laboratories already dependent on, and supported by, the Ministry, and also other stations and laboratories which it may be deemed expedient to open ; the cost of building and upkeep will be borne by the Institute. It will also aid other stations and laboratories which have hitherto been maintained by the Ministry of Agriculture, and have the power to make payments to scientific experts engaged upon agricultural research. Its essential duties will be : to coordinate the work of specialists, encourage research, giving it a bias towards practical utility rather than speculative science, to found a central library and publish a summary of the scientific work carried out both in France and abroad.

The Institute was built at the beginning of 1922 ; and ROUX, Doctor of Science and State Councillor, was appointed Director. His Board of Administration is composed of a chairman and 28 members appointed for a period of 4 years, 6 members being chosen by the Academy of Science, 6 by the Academy of Agriculture, and 16 by the Ministry of Agriculture ; among the latter are 3 Members of Parliament, 3 well known agriculturists or scientists, 3 members of Agricultural societies and one member proposed by the Ministry of Finance. The administration of the Institute resembles that of a municipality and an annual budget is issued. It is also in touch with the Sanitary, Scientific and Suppression of Fraud Departments. It has in its service 115 officials formerly attached to the laboratory service. It has under its direct control 24 stations or laboratories ; 24 others, already supplied with educational facilities receive from it the staff and funds necessary for research work ; and 36 other stations under the control of the Departments receive grants from the Institute.

Consequently the Institute can rely on the support of 84 regularly established bodies ; it is organised on regular lines and its system forms a

network of which the junctions are the centres of agricultural districts with branches in the places where research is to be carried on. An agronomic engineer is placed in charge of the central office of documentation.

A central laboratory which will direct the work in progress at the other laboratories and carry out the more intricate tests, is established at Chêvreteux (Rocquencourt) where 5 central stations will be erected on an area of 30 ha.: 1) one for physics and climatology; 2) one for cultivated soil; 3) one for plant breeding; 4) one for general pathology; and 5) one for zoology and agricultural entomology. The Institute will thus supply the present deficiency of specialised laboratories for science applied to human and animal food, for apiculture, oliveculture and dairy-farming. The existing laboratories will be assisted, strengthened, completed, and stimulated for their work; where required, new laboratories will be founded and placed in touch with the whole system.

The report made by the author describes the work which lies before the Institute of Agronomic Research. He is convinced that this task will be carried out methodically and at the same time vigorously and with set purpose, and that the Institute will not fail to contribute largely to agricultural progress.

R. P.

## CROPS AND CULTIVATION

908 — **Studies on the Reactions between Soils and various Chemical Compounds.** — SPURWAY, C. H., in *Michigan Experiment Station Bulletin* No. 51, pp. 5-29, bibliography of 10 works. East Lansing, Mich., 1921.

SOIL PHYSICS

In order more accurately to interpret the reactions between soils and chemicals commonly applied as fertilisers the author considered that it was necessary to extend his investigations and experiments on the effects of these compounds on soils of different kinds, taking into account the nature of the soils as well as the specific action of the fertiliser salts and the compounds employed. The author is convinced that whatever may be the explanation of the processes which bring about these reactions, further progress depends upon an increase in our knowledge of the chemical constitution of soils and the practical significance of the soil components, and in devising analytical methods for the estimations of these components.

The difference in the results obtained and in the conclusions arrived at by many of the investigators engaged upon this question, is probably due to the fact that they have carried out their experiments with materials of different chemical constitution and composed of chemicals belonging to different groups, and also to the diversity of the analytical methods employed. On consideration of the work done in this field there appear to be three main ideas, or lines of thought: 1) that between the soil and chemical compounds there are chemical reactions only; 2) that the phenomena observed can be explained by physical forces; 3) that both chemical and physical reactions take place at the same time.

The author describes his experiments, undertaken as a study of the reactions between neutral salts, bases and hydrolysing salts, and basic

or acid soils of various classes. In these experiments the soil reaction was always tested with litmus paper. In order to eliminate the possibility of secondary and continuous reactions, which undoubtedly occur with slow filtration, the decantation method was used. The procedure was always as follows: 100 gm. of air dried soil were well mixed for one hour with 500 cc. of solution, usually 1/50 Normal of the salt under consideration, at laboratory temperature. The liquid was then decanted and filtered rapidly through paper. The extracts so obtained were analysed by standard methods for the particular salt. All calculations of results were based on 500 cc. of solution.

I. — *Treatment with neutral salts.* — Experiments were made with soils of various types, e. g., sandy loams, silts and clay-loams, with and without carbonate, and with solutions of chloride, sulphate and nitrate of potash; sulphate and nitrate of ammonia; nitrate and sulphate of lime and chloride of magnesium. The analytical results obtained were recorded by the author in tabular form, and it appears that in practice in the reactions between the soil and neutral salts the cation only is retained. Practically all soils without exception precipitated the cations of neutral salts, and an equivalent quantity of another element contained in the soil was set free and passed into solution. The application of potassium salts caused the liberation of an equivalent quantity of other soil elements, particularly calcium and magnesium which went into solution. In the case of treatment with calcium, the calcium is fixed and magnesium goes into solution; with magnesium chloride the calcium is found in solution and a corresponding amount of magnesium is fixed. The actions were reversible in all the cases studied. After the reaction, with one or two exceptions, all the solutions were alkaline. Soils having an alkaline reaction fixed a greater quantity of cation than acid soils of the same class. There is strong proof that the reactions involved are chemical in nature and that the cause of fixation in soils is the presence of soil elements, chiefly calcium and magnesium, and that the degree of fixation is dependent upon both the kind and quantity of reacting elements present. A soil which has received an application of magnesium chloride is able to fix a larger quantity of lime than one not so treated.

II. — *Effects of Hydroxides.* — The same general methods were adopted as in the case of neutral salts. Experiments have been made with solutions of caustic potash and also with hydrate of lime. In these experiments it was found that soils of all types, whether of alkaline or acid reaction, fixed considerable amounts of potassium or calcium from their hydroxides without an equivalent exchange of other elements. After treatment with caustic potash the solution was alkaline to phenolphthalein and contained iron, aluminium and silica but the quantity of calcium was very small, much less in fact than the solubility factor for this element in the form of hydrate.

Evidently potash was fixed from caustic potash without an exchange of calcium or magnesium and in addition iron, aluminium and silica passed into solution in considerable quantities. The potash thus fixed could be

set free again and replaced by calcium on treating the same soil with solutions of the chloride or hydrate of calcium. In general it may be stated that soils having an alkaline reaction fix a larger quantity of cations than those with an acid reaction, although they may belong to the same class of soils.

III. — *Effect of Hydrolysing Salts.* — The same experimental methods were always followed in dealing with potassium orthophosphate, mono-calcium-orthophosphate, calcium acetate, potassium acetate, potassium oxalate and iron chloride.

These salts may be grouped into four classes according to their action on the soil : a) salts with an alkaline reaction ; b) salts with an acid reaction ; c) salts which form soluble salts by combination of their acid radical with the soil elements ; d) salts whose radical acid forms insoluble compounds.

In general it may be said that under certain conditions salts which undergo hydrolysis give results similar to those of neutral salts, but under other conditions the results are quite dissimilar. When the acid radical of the salt is capable of forming a soluble compound with the soil elements a reaction follows which is analogous to that obtained in the case of neutral salts. The soil cation is fixed and then a quantity equivalent to that of the soil element goes into solution. When on the contrary, the radical acid of the salt forms an insoluble compound with the soil element, usually in this case lime or magnesia, the two ions of the salt under consideration are fixed by the soil, but in different proportions from the chemical standpoint. This implies that the two ions can be fixed independently one of the other. As regards the basic or acid reaction of a salt, it can be seen that when the reaction is alkaline, that is, when the acid radical is removed, the result is the same as in the case of the corresponding hydroxide ; when the reaction is acid the final result is the same as that obtained on treatment of a soil with the corresponding acid. For example, on treatment with ferric chloride, a salt with an acid reaction, the amount of iron fixed by the soil is proportional to the quantity of lime found in solution, although it is only in the case of soils rich in lime that an appreciable amount is found in solution. The experiments indicate that it is doubtful whether the iron fixed by the soil can be replaced and that it is probably held in the hydroxide form. Hence the reaction would not be reversible. It may be observed that the alkaline soils fixed a greater quantity of cations from hydrolysing salts than the acid soils of the same class, and also, that greater quantities of cations were fixed from hydrolysing than from neutral salts.

The data accumulated in this research point strongly to the conclusion that when neutral salts, hydrolysing salts or hydroxides in solution, are placed in contact with soils, a chemical reaction results in which the cations or basic radicals of the added compounds are precipitated in the soil mass and the anions or acid radicals of the salts used form soluble compounds with calcium or magnesium, the resulting salts being found in the soil solution. When, on the contrary the radical acid forms an insoluble compound with calcium or magnesium, then that also is fixed or precipitated in the

soil. The results obtained are in accord with WAY's chemical hypothesis (*Journal Royal Agr. Soc.*, Vol. II, 13 and 15) and form an important demonstration of soil phenomena, particularly as regards the mineral constituents. These results justify the conclusion that almost all soils have acid and basic properties in common because they neutralise acids and also alkalies. The differences noted were quantitative only and these differences were generally in favour of alkaline soils over acid soils of the same type. Apparently the reaction of a soil is to a large extent determined by quantity relationships, the mass action of its components, above all by the quantities of the reacting masses involved.

A neutral soil then represents a case where the active masses of reserve alkalinity and acidity are equivalent.

The above is of practical value with regard to knowledge of soil fertility. In order that some fertilising element may be held, it is essential that the soil itself should contain some other reacting substances such as calcium or magnesium, which are probably present in the form of silicates.

This work shows the importance of making a special study of each soil if the best results are to be obtained from the use of fertilisers.

L. M.

909 - **Aluminium Salts in the Soil.** — DENISON, I. A. (Agricultural Experiment Station, University of Illinois) in *Soil Science*, Vol. 13, No. 2, pp. 81-106, bibl. of 16 works. Baltimore, Feb. 1922.

It is known that salts of aluminium are present in soils in considerable quantities and are partly responsible for soil acidity. The toxicity of these salts towards crops has been demonstrated by numerous investigations, but there is no definite information regarding their effect upon the processes of ammonification and nitrification. To solve this problem, the author carried out a series of investigations under the direction and with the aid of A. L. WHITING. Acid soils treated with distilled water left no trace of aluminium, so that this element cannot exist in a soluble form in the soil. On the other hand, it dissolved in a solution of potassium nitrate, the HOPKINS method for determining soil acidity. In this state it does not dialyse through a collodian membrane, and is present probably in the form of hydroxide. Under the influence of mineral acids which displace the aluminium, this hydroxide may give rise to soluble salts of aluminium which are the consequence, and not the cause, of the acidity. Aluminium salts stimulate ammonification, but act adversely upon nitrification, which is explained by the fact that they produce hydrogen-ions. Their influence gradually decreases, and after a couple of months the adverse action upon nitrification disappears. The same effect may immediately be obtained artificially by means of calcium carbonate, and in a lesser degree by tricalcic or monocalcic phosphate, because the calcium-ion precipitates the aluminium-ion. Under natural conditions, aluminium is never able to exercise a toxic action by means of its own soluble salts, even in acid soils, because it is rendered or kept insoluble by such actions.

L. V.



910 - **Nature of Soil Acidity in North-East India.** — CARPENTER, P. H., and HARLER, C. R., in *The Indian Tea Association, Scientific Department, Quarterly Journal*, pt. III, pp. 121-144, bibl. of 32 works. Calcutta, 1921.

Soil acidity is insufficiently studied in tropical and sub-tropical countries. The authors have studied it in the tea-growing districts of North-East India, where it diminishes production, either because it lowers soil fertility or because it facilitates the outbreak of certain diseases.

Soil acidity may be due to various causes. Its extent may be measured by numerous methods, which react in varying proportions on the factors which cause it; this explains why they do not agree among themselves. They are based on hydrogen-ion concentration (electric conductivity, calories, saccharose inversion, liberation of iodine etc.), on neutralisation by means of bases or salts with a basic action, carbonate, bicarbonate and hydrate of calcium, barium or sodium, calcium acetate, etc., on a solution of weak bases (aluminium or iron contained in the soil) by means of neutral salts (potassium nitrate, soda nitrate, etc.). The authors find that these methods, often too drastic, are all inexact or uncertain. The "Indian Tea Association" recommended the ALBERT method modified by LYON and BAZZILL. It consists of treating the soil first with barium hydrate, then with ammonium chloride. The authors have used it largely, but do not believe it is exempt from the criticism passed on the other methods. Though not perfect, they prefer HOPKINS' potassium nitrate method. It measures more especially the quantity of aluminium dissolved in the soil or capable of entering into solution. This method, then, not only enables the actual acidity to be measured, but also the potential acidity, that is, that which may be liberated, which is of equal importance. The first is united to soluble and ionisable aluminium silicates, the second to aluminium hydroxide derived from silicic minerals in soils undergoing laterisation; this colloid's degree of hydration affects the latent acidity of the soil.

Aluminium also dissolves easily in calcium hydrate. This is surprising, since calcium aluminate is insoluble; it is evident that the aluminium passes into solution as a silicate. It also dissolves in basic hydrates.

According to the authors, everything points to ionised aluminium as being the chief cause of the actual and potential acidity of the soils studied in India. In this connection, the authors remind us that CONNOR, ABBOT and DAIKUHARA have proved that aluminium and iron may be found in the soil in a state of solution as acid silicates in the absence of sufficient quantities of lime and magnesia to neutralise these salts; also that the aluminium in solution sufficiently explains the lack of fertility in acid soils, as it has a direct toxic action on the plants and bacteria of the soil, even in minute quantities ( $1 : 1\,000\,000$  of aluminium-ion).

The degree of acidity registered by HOPKINS' method differs entirely from that determined by steeping the soil in lime or other bases, but there is a close parallel between this degree and the fertility. This shows the influence of dissolved or soluble aluminium (ionised or ionisable) in regulating fertility, and proves the importance of these determinations.

According to the authors, the acidity caused by aluminium, which is common in the tropics, is favoured not only by the absence of lime or magnesia, but also by the imperfect drainage, heavy rains, irrational methods of culture etc.

Potash added to acid soils always diminishes their fertility at first because it renders the aluminium salts soluble and increases their toxicity. But if the soils are light and permeable, the aluminium is rendered soluble and afterwards quickly liberated, as proved by MIRASO; thus, after the first year, the potash is very beneficial; the soils become better adapted to tea culture, the yield is considerably increased and certain parasites, such as the *Helopeltis Thevora*, disappear. On clay soils, however, which cannot be easily leached out, the aluminium remains even after having been rendered soluble by the potash, which only does harm. As the clay soils cannot be leached out, they collect soluble aluminium, which is the cause of infertility.

Lime, in the form of carbonate, superphosphate, etc., also has a good effect, similar to that of potash. According to the authors, this is due to the fact that it precipitates aluminium, renders it impervious to attack even from the acids freed from organic manures and fixes it strongly and permanently in the soil. Besides this, it neutralises acidity; probably these two actions are to some extent connected, whereas, according to HOAGLAND, they are only coincident. L. V.

911 - **Soil Acidity and Bacterial Activity.** — STEPHENSON, R. E. (Agricultural College, University of Kentucky) in *Soil Science*, Vol. 12, No. 2, pp 133 144 and 145-162, fig 1, bibl of 13 works. Baltimore, Aug 1921

It has not yet been decided how and why soils become acid. In the decomposition of organic matter, bases and acids are formed, for instance, the processes of ammonification and nitrification. The products thus formed subsequently undergo changes; for instance, the acids react on the mineral substances of the soil, of which they hasten the disintegration and increase the availability, but which are sometimes precipitated, thus delaying their absorption by plants.

All these substances are partly absorbed by plants, which tend to keep the soil neutral by a process of auto-regularisation, plant growth being hindered by acidify; they are brought into contact with the water, which tends to acidify the soil by setting free its bases; the substances however are partly restored by vegetation and manuring. Many factors therefore unite to produce and regulate soil reaction. Among these, evidently decomposing organic matter exercises an important influence, but little research has been made on this question.

The author had already studied (1) the effect of the decomposition of some of these substances, nearly all of definite chemical composition; albumin, casein, dextrose, ammonium sulphate, starch, blood and alfalfa. But he wished to study other organic materials of more general use in agri-

(1) See R. 1919, No. 1084 (Ed)

culture, such as farm manure, cottonseed meal, dried blood, clover and other green crops, and oat straw. As in the earlier work, he used two soils, one rather sandy and light in colour, the other of the loam type, dark and fairly rich in organic matter ; tests were made in earthenware jars, fertiliser being added to the soil at the rate of 5000 lbs. per acre, on the basis of 2 000 000 lbs. of soil per acre ; straw was added generally in smaller quantities. In many tests he also used calcium carbonate precipitates in half the quantities above mentioned.

Soil acidity, as determined by the TACKE method by means of hyper-saturating with calcium, does not increase when decomposing organic materials are present, unless there is a large production of nitric acid. The addition of lime always increased nitrification ; it is evident that the lime, saturating the nitric acid, prevents the latter from becoming too concentrated, in which state at a certain moment it injures the bacteria which cause acidity and thus automatically stops the process of nitrification. With limestone, the nitrifiers become more active ; at the same time however ammonification becomes less intense. If nitric nitrogen and ammoniacal nitrogen be added, smaller quantities are found in limy soils, probably because the lime renders the micro-organisms more active, and these eventually assimilate and make organic the ammonia compounds and the nitrates, which no longer exist as such. Certain natural fertilisers, such as horse manure, produce small quantities of ammonia and nitrates, perhaps because they cause a vigorous growth of micro-organisms. Straw also reduces change and nitrification.

The soluble unknown non-protein nitrogen, not including the nitrates and ammonia compounds, showed little effect under the various organic treatments. Only the cottonseed meal gave any large increase. In all cases lining decreased the nitrogen content.

In practically all cases the soils show reaction under acid and organic treatment, but without greatly modifying the true acidity as determined by hydrogen-ion concentration. This is especially true of soils rich in organic matter and clay. Thus citric acid remained inactive in hydrogen-ion concentration. On the other hand, the acidity was always increased by the addition of a mineral acid, such as sulphuric acid. A similar action is certainly exercised by hydrochloric acid, acid silicates, etc., which are found in certain manures and fertilisers. It is interesting to note that neutral salts act in the same way as mineral acids ; for instance, ammonium sulphate is physiologically an acid because, while destroying the organic basic radical, the mineral-acid radical remains ; it is more active than a similar quantity of albumin because the latter forms nitrogenous bases which nitrify slowly ; on the other hand, it is more active than a like quantity of sulphuric acid. The addition of a mineral base decreases the acidity in every case ; certain neutral salts also act as bases : thus, limestone decrease hydrogen-ion concentration to a little over 8 pH, which seems to be the alkaline limit caused by limestone.

L. V.

912 - **Nitrogen Economy in Soils.** — BEAR, F. E. (Professor of Agricultural Chemistry and Soils, Ohio State University, Columbia) in *Journal of the American Society of Agronomy*, Vol 14, No. 4, pp. 136-152, bibliography of 35 works. Geneva Conference N. J., 9 figs., bibl. April 1922.

In 1840 LIEBIG stated that nitrogen in the form of ammonia dissolved in the rain was the source of the nitrogen used by plants. Estimations carried out subsequently by LAWES and GILBERT and exact determinations made recently by RUSSELL and RICHARDS prove that the amount of nitrogen supplied to the soil in the rainfall is usually not more than from 5 to 8 lb. annually, although occasionally the amount may be as much as 15 to 20 lb. per acre; but the quantity tends to increase with a greater rainfall and also with nearness to industrial centres.

Atmospheric nitrogen is fixed in the soil in considerable amounts by two distinct bacterial processes. One, termed symbiotic, is effected by *Bact. radiculicola* which exists in the roots of leguminosae. The work of this organism can be estimated by three methods: comparison between legumes and non-legumes; comparison of inoculated and non-inoculated legumes; analysis of the soil before and after the experiment, taking into account the nitrogen which may be added to or removed from the soil by any cause. The amount of nitrogen supplied to the soil by this means is considerable. ARNY and THATCHER have shown recently that melilot is able to fix nitrogen to the extent of 133 lb. per acre per annum, but as a rule the quantity is very much smaller. Nitrogen fixation is known to be stimulated by the use of phosphorus, potassium and lime, and leguminous plants are thus indirectly assisted as their nitrogen requirements are supplied. Nitrogen fixing bacteria are sensitive to acid conditions in varying degrees. FRED and DAVENPORT found the optimum pH for soybean to be 3.4 as compared to 4.3 for those of clover and 5.0 for melilot and lucerne. SALTER finds that the optimum for the soil is about 1 pH higher than would be expected from culture solutions. It may be possible, as suggested by LYON, to grow acid-tolerant legumes on soils in which nitrification is retarded. In addition to the symbiotic fixation of atmospheric nitrogen there is the non-symbiotic process carried out by free-living bacteria of which *Azotobacter* is the prototype. There are other organisms belonging to this group, which are able to function in acid soils unsuited to *Azotobacter*.

It has been shown by FRED and GOLDING that *B. radiculicola* has the capacity to fix nitrogen when free in the soil and absent from its host. The conditions which favour both symbiotic and non-symbiotic bacteria are similar and include the presence of carbonaceous and mineral matter. The non-symbiotic types are less active but time is on their side as they work continuously whereas the other form is active only in the presence of its host-plant; they thus play an important part in the supply of soil nitrogen. Investigators have estimated the quantity of nitrogen fixed by *Azotobacter* at from 15 to 14 lb. per acre per annum. All these organisms choose the line of least resistance for obtaining their food and after the available nitrates present in the soil have been utilised they then assimilate atmospheric nitrogen (BONAZZI). A third source of

nitrogen is that supplied by fertilisers which is more effective in some areas than others, for instance in Texas as compared with Ohio. This is related to the causes of the loss of soil nitrogen which vary in different districts. Nitrification actually entails a loss, as it renders nitrogen soluble and in this case if not immediately absorbed by plants it is easily washed away. Nitrification is hindered by acidity and assisted by alkalinity. In cold regions both nitrification and fixation of nitrogen are slow.

The opposite is the case in warm countries. The fixation of nitrogen by leguminosae is more rapid than the process of nitrification and in consequence a storage of nitrogen results. Experiments show that the greatest quantity of nitrogen is found in soils which are neutral or slightly acid and that there is an *optimum* reaction of about 6 pH.

Soil nitrogen is diminished by irrigation; LYON and BIZZEL, in the course of their lysimeter experiments shewed that this loss amounted to about 3.4 lb. per acre, excluding the first year in which cultivation of the soil increased the quantity; they also showed that the loss is closely related to the kind of crop grown. In the absence of vegetation the nitrogen loss averaged about 100 lb. per acre annually. This loss may be made up in practice by the cultivation of leguminous crops provided that phosphate and potash salts are applied, as was shown in the cylinder tests carried out at the New Jersey Station. The field experiments confirmed these results. On reviewing the subject it is seen that the nitrogen equilibrium is a result of many factors; rainfall, soil reaction, cropping system, temperature, manuring, irrigation, type of soil, presence of worms, insects, etc. The loss may be made good by sound methods of rotation and by so doing the amount of manure necessary will be reduced to a minimum. The most economical and the best plant growth is obtained when the losses and gains of nitrogen in the soil balance each other.

L. V.

913 - **The Isolation of Sulphur-Oxydising Bacteria from the Soil** (1). — JOFFE, J. S. (New Jersey Agricultural Experiment Station) in *Soil Science*, Vol XIII, No 3, pp 161-172, bibliography of 35 works. Baltimore, March 1922.

The author gives a general description of the sulphur-oxydising organisms, and abstracts are here made of some of his lesser-known studies. Apart from the classical sulphur-bacteria *Thiothrix* and *Beggiatota* he mentions the following groups: 1) *Rodobacteria*, already described by WINOGRADSKY, of which the typical species is given the name of *Thiorhodaceen*. They were discovered in 1826 by EHRENBURG, who named them *Monas okenii*; they are able to thrive in the light and need very little oxygen. 2) *Thiosulfobacteria* discovered by NATANSOHN in 1903; in 1904 BEIJERINCK described a typical species of *Thiobacillus thioparus* which was able to convert thio-sulphates into tetrathionate; 3) denitrifying *sulphobacteria*, discovered by BEIJERINCK in 1904 and studied by LIESKE in 1912. They are known as *Thiobacterium denitrificans* and thrive in the absence of oxygen, which they obtain from nitrates, and liberate nitrogen; 4) another

(1) See R. Aug. 1922, No 804. (Ed.)

similar group of sulphur bacteria is mentioned by DÜGGEI which are non-threadlike organisms termed by HINZE *Thiophysa volutans*, *Thiospirillum urinogradoki* Omeliansky, *Spirillum gralatum* Molisch. The author refers to the work of GICKLEHORN who described in a less exact manner a number of sulphur organisms.

With a mixture of soil, sulphur and basic phosphate of lime, the author was successful with a number of cultures carried out in a liquid containing neutral phosphate of potash, carbonate of lime or magnesia, nitrate of soda, sulphur and saccharose or dextrine. In the original cultures only 8 to 9 % of the sulphur was oxidised but the acidity of the mixture was increased; in many instances the cultures deteriorated but in two cases the oxidation of sulphur reached 18 %. The author tried to isolate the micro-organisms by employing the same media solidified with agar and obtained some bacterial colonies, both motile and non-motile and also fungi. Transfers of the bacteria to the liquid media did not produce an acidity equal to that of the original liquid culture medium. Platings carried out at a later stage gave no bacterial result. The author then replaced sodium nitrate by ammonium chloride as a source of nitrogen. He thus obtained a good medium in which the organisms were increasingly active and gave an acidity of 1.2 pH. He succeeded in obtaining by means of these transfers a pure culture of bacteria which were very active in the presence of sulphur. This organism in 150 days oxidised 48 % of the sulphur contained in the culture and gave a strong acid reaction below 2 pH. He has made experiments in collaboration with LIPMAN and WACKMAN which will be published separately. The author has shown that a number of micro-organisms are able to some extent to oxidise sulphur. Experiments were carried out with two fungi (*Mucor* and *Fusarium*) and also with two bacteria which grew well on CZAPPECK'S solid medium. These germs to some extent dissolved insoluble phosphate, no doubt owing to the action of the sulphuric acid produced. These germs interact amongst themselves. The author, for this reason, accepts the opinion expressed by LIPMAN that the process of sulphur oxidation in the soil is a result of the associated activities of different forms of micro-organisms, some of which bring about the oxidation which is then continued by others.

L. V.

914 - **A Method for counting the Number of Fungi in the Soil.** -- WAKSMAN, S. A. (New Jersey Agricultural Experiment Station, Department of Soil Chemistry and Bacteriology) in *Journal of Bacteriology*, Vol. 7, No. 3, pp. 339-341. Baltimore, May 1922

The spores of hyphomycetes and other fungi in the soil are estimated by the plate method with the same media and dilutions as are used for bacteria. As these bacteria are very numerous, the dilution of the soil is necessarily very high, but in these dilutions the fungi become so rare that very few appear on the plate in fact many plates are entirely free from fungi. The work therefore becomes impossible, or involves great error. But if the dilution of the soil be reduced, the bacteria become so numerous as to prevent the development and consequently the numbering of the fungi.

This difficulty was obviated by making use of acid media in which bacteria do not develop but fungi grow readily ; in this way a very low dilution of soil may be used. The author now gives the formula of an acid culture which gave very good results. In an experiment, he found 29 400 ( $\pm$  1700) germs per gram of soil, whereas with agar-agar and egg-albumen an impossible 460,000 ( $\pm$  94 000) were found, that is, 20 times as many ; the soil dilutions in these two cases were respectively, 1 000 and 200 000. The method may also be applied to the determination of the number of fungi in food preparations. The formula is as follows : glucose 10 gm. ; peptone 5 gm. ; acid potassium phosphate 1 gm. ; magnesium sulphate 0.5 gm. ; distilled water 1000 cc. Boil, add sufficient sulphuric acid or phosphoric acid to bring the reaction to 3.6 to 3.8 pH (usually 12-15 cc. are sufficient) ; add 15 gm. of agar, boil, run into tubes and sterilize as usual. The final reaction should be 4 pH. L. V.

915 - "Plant Cancers" and their Relation to the Soil: studied on the *Beta vulgaris*. -- LEVINE, M. in *American Journal of Botany* Vol 8, No. 10, pp. 507-525, bibl. of 18 works. Lancaster, Pa., Dec. 1921.

The numerous varieties of *Beta vulgaris* are subject to a sporadic disease which shows itself in the form of large tumors on the roots. There are two kinds, one called crown gall and the other tubercular disease. They are caused by two bacilli, respectively known as *Bacterium tumefaciens* and *Bacterium beticola*, which were discovered by SMITH, BROWN and TOWNSEND (1911). TOWNSEND (1915) concluded that the galls have no marked effect upon the size of the sugar beet and JENSEN (1918) found they had no detrimental effect on mangel wurzels. He observed that the large tumor-like formations on the sugar beet are of very irregular structure and that the tumor in almost every case is small in the garden beet. Many questions still remain to be decided : to ascertain more exactly the effects of the tumor on the roots and leaves of the plants attacked ; to determine the cause of the greater susceptibility of the sugar beet in comparison with other varieties of the *Beta vulgaris* ; to try to produce races proof against attack which will retain their qualities ; to differentiate the two kinds of disease from the histological point of view, and to study the relation of the disease to the soil.

The author undertook this last problem and proceeded to solve it by systematic research and weight determinations. He experimented on 3 varieties of *Beta* : mangel wurzel and two garden varieties. When the tap roots began to appear, he inoculated them with from 5 to 10 injections made with a needle dipped in a culture of *Bact. tumefaciens* ; 3 types of tumors were thus regularly produced : smooth, warty and mixed. For the pot tests, four kinds of soil were used : garden soil mixed with plenty of manure ; brown clay loam with manure ; the same without manure ; and sand. The growth of the plants decreased in the same order and that of the tumors also diminished in the same proportion. In the first soil a similar result was observed ; in the two highly manured lots, the inoculated mangel wurzels showed vigorous growth and the tumors on their roots were

large, whereas in the sandy unmanured lot the plants and tumors were poorly developed.

This disease therefore seems to develop more actively on the better nourished plants, especially those treated with nitrogen compounds. The writer recalls certain similar facts observed with regard to other plants. He also points out that the analogies of crown gall with animal cancer, recognised by SMITH, JENSEN, the writer and others, are increased by this action.

L. V.

916 - **Soil Factors and Plant Growth.** — MOORE, B., in *Ecology*, vol 3, No 1, pp 65-83, 6 figs., bibl. of 12 works Brooklyn, Jan. 1922.

Among recent investigations on the importance of the soil in controlling plant growth and distribution, that of FERNALD on the distribution of *Pinus Banksiana* and *Thuja occidentalis* in connection with geological formation, and that of HESSELMAN on the importance of different kinds of humus in Swedish forests are deserving of attention. The beneficial influence of humus on plant life has long been recognised, but it was attributed solely to its effect upon the water-holding capacity of the soil and to its rendering the latter lighter and better ventilated, whereas HESSELMAN recognised that it is an effective agent in nitrogen production. The influence of soil reaction on plant growth has often been studied, but most attention has been given to acidity and alkalinity has thus been neglected.

The writer has studied the influence of humus and alkalinity on certain conifers (3 pines and a cedar. *Pinus rigida*, *P. Banksiana*, *P. Resinosa* and *Thuja occidentalis*), on a sugar maple (*Acer saccharum*) and on wheat. The soils were of pure sand, pure humus and a mixture of 80 % of sand with 20 % of humus. To eliminate the effects of the greater moisture-holding capacity of the humus, the soils were kept continually moist. For the plant-growth determinations, the height from the ground and the depth of the roots (of the pines only) were measured, the green weight was taken, and also the dry weight of wheat. Certain qualities, as indicated by appearance, colour, etc., were also noted.

On the whole, growth was difficult in sand, less so in the mixture of sand and humus and vigorous in humus, in spite of strong acidity. Evidently humus supplies nutriment which can be no other than nitrogen.

As regards conifer seedlings, the influence of humus was greatest in the case of *Pinus Banksiana* and *P. rigida*, less with *P. resinosa* and still less with *Thuja occidentalis*, which came up with difficulty in spite of the humus. These results lead to the conclusion that humus is especially beneficial to trees which in a natural state also grow on sterile soils; on the other hand, trees which require better soils find humus insufficient. The growth of wheat, a cultivated plant, was also little affected by humus with the exception that it favoured the growth of stems or shoots owing to its rich nitrogen content as compared with its carbon content. This accords with the observations of other writers.

Soil alkalisation was produced by the writer by means of quick-lime. He tried two types, one stronger (with 2.0 %, 2.4 % and 4.0 % of lime,



according to the soil type), and the other lighter (with 0.75 %, 0.8 % and 0.5 % of lime). Even a weak alkalisation still had a very unfavourable influence on seedlings, with the exception of those of the cedar. Sugar maple seedlings when transplanted all died immediately, except those planted in the sand. Numerous seedlings of other species also died; those which survived were poor in growth. The roots of the conifers became brown and shrivelled. This injurious effect diminished in time but was still marked after 40 days.

Large quantities of lime also had a decidedly unfavourable effect on wheat, not so much as regards height as weight, which was taken both before and after drying in an oven. This effect was more marked in cultures made in sand or with a little humus; it was hardly noticeable in pure humus cultures. On the other hand, moderate quantities of lime showed a favourable influence, especially on humus cultures, in which, with the addition of lime, wheat grew better than in the untreated soil.

Wheat therefore differs from trees in this respect, which shows that care should be taken in applying the results obtained with cereals to trees, and vice-versa.

L. V.

917 - **Soil Acidity and Plant Composition of a Peat Bog.** — MOORE, B and TAYLOR, N. (Brooklyn Botanic Garden), in *Ecology*, Vol. 2, No. 4, pp. 258-261. Brooklyn, Oct. 1921.

Mt. Desert Island lies off the eastern coast of the state of Maine. The predominant vegetation is northern, with a number of arctic alpine plants, but southern forms are also found. A similar combination of northern and southern forms is found in the insect fauna of the island. On the south side of the island is a small bog 50 yds long by 25 wide, which is caused by an undrained depression in a granite formation which forms a great part of the island. The bog is covered with marsh plants, chiefly sedges. Its specific acidity is pH 4.5-4. The drying up of the water in summer, instead of making the acids stronger through higher concentration diminishes their intensity. Around the edge of the bog is a granite outcrop covered with vegetation. Under the roots of the *Empetrum nigrum* the acidity is lower, being pH 5.0 only.

Round the margin of the bog is a stunted growth of black spruce (*Picea nigra*) with a mixture of larch and other plants; here the acidity is still lower, being pH 6. In these three zones of varying acidity, the flora changes not only according to environment, but also according to origin. In the first zone, there are 25 % of arctic alpine plants, in the second 6.3 % and in the third, none at all. In the author's opinion, the first zone contains the older species and the other two zones contain a progressively increasing number of those subsequently introduced.

L. V.

918 - **Influence of Soil Reaction on Earth Worms.** — ARRHENIUS, O (Stockholm), in *Ecology*, Vol. 2, No. 4, pp. 255-257, bibl. of 7 works. Brooklyn, Oct. 1921.

After referring to the brilliant studies by C. DARWIN and P. F. MÜLLER, according to which the presence or absence of earth-worms largely determines the condition of the soil as regards acidity, the author mentions a hypothesis previously formulated by himself viz., that the two kinds

of soil depend, on the contrary, upon their hydrogen-ion concentration. Against this hypothesis it could be objected that the earth worms are capable of causing both the chemical reaction and the soil type. The author therefore wished to discover what modifications may be produced by earth worms on soils with different reactions. He modified the soil reaction by adding decinormal solutions of sulphuric acid and potassic hydrate or iodine hydrate, in each case with the same quantity of water (50 %). After the preliminary experiments, by simple interpolation calculations he prepared a series of soils measuring entire units of pH from 3 to 10. After having checked the hydrogen-ion concentration of this soil, he added a certain number of earth worms. After the first series of experiments in the "Treublaboratorium of's Lands Planentune", Buitenzorg, with the usual Javanese earthworm *Perichacta indica* Horst, the worms, after 4 or 5 days, were living and vigorous. In pH 6 and 7 concentrations, there had even been propagation, whereas, in the other concentrations, the worms were dead or dying. In another experiment in the Laboratory of Soils and Bacteriology, in the University of California at Berkeley, the results were even more convincing with *Lumbricus terrestris* L. After 3  $\frac{1}{2}$  days the worms only remained alive in the pH 6 and 7 concentrations. This proves that earth worms not only cause soil reaction but are themselves strongly influenced by it. This is in accord with the experiences of other authorities. For instance, PRISCOU informed the author that in Egypt there are no earth worms in the best soils, and from the observations made by the author, nearly all good Egyptian soils have a pH above 7.5. The observations of A. F. SHOHL and SH. H. KWIIZ may also be quoted, according to which the irritability of the earth-worms (*Allobophora foetida* Sav.) is proportionate to the hydrogen- and hydroxyl ion concentration.

To conclude, in the author's opinion, the reaction is the primary factor in the soil type.

L. V

919 - **Quantity of assimilable Phosphoric Acid and Potassium in Soils.** BRIOUX, CH. in *Annales de science et d'agriculture* Year XXXIX No. 2, pp. 82-100. Paris, March-Apr. 1922.

Agronomists and chemists still disagree as to the utility of chemically analysing arable land, such analysis as yet being far from a sure guide as to what, if any, fertiliser should be used. From deductions made which have been disproved in practice, the utility of this analysis has been questioned. It has been confined, in fact, to determining the four principal elements forming the fertilising reserve of the soil: total nitrogen, phosphorus, potassium and calcium, the last three being soluble in concentrated boiling acids. It is useful to know the quantity of nutritive reserves, but this will only be of relative value if the proportion of fertilising elements which may be available for plants, cannot be estimated at least approximately; this proportion indicates the degree of fertility.

Some important data have already been ascertained. The problem is to find the solvent to be adopted which would have an action comparable to that of the roots of the plants cultivated, or preferably, to that of

the general phenomena of solubility through which the plants can be nourished. The author tries to find solvents which, with the present means of analysis, will give results more in conformity with those obtained in practice. Among other experiments, the author makes a comparative study of two methods for estimating the assimilable phosphoric acid and potassium viz., B. DYER's and TH. SCHLOESING junior's afterwards A. DE SIGMOND's, methods.

DYER, who had at his disposal at the Experimental Station of Rothamsted soils which had received applications of fertilisers for 30 years of which the action was perfectly well known, employed the following method: after having determined in a large number of plants the acidity of the sap contained in the fresh roots, which is about 0.85 %, he treated them with a solution of citric acid at 1 %, finding between the parts untreated and those phosphated a ratio of 1 : 1.7 for the total phosphoric acid, soluble in boiling hydrochloric acid, and 1 : 6 for phosphoric acid soluble in weak citric acid. It may be presumed that the latter only dissolves the phosphoric acid which can be assimilated by the plants and is found in small quantities in the untreated parts; hence the marked difference between the terms of the second ratio. DYER obtains similar figures for potash. On comparing the results of the analyses with those of the cultures he confirms the fact that citric acid acts on phosphates and potash in nearly the same way as the natural solvent formed by the plants.

He gives the following practical rules: arable soil should contain at least 5.10 % of phosphoric acid soluble in 1 % citric acid for cereals and an appreciably higher percentage for root cultures. Though it is difficult to foresee whether the addition of potassic salts is beneficial, the figures for potash are the same.

GAROLA in applying DYER's method, increased the limits slightly, generally using phosphatic fertilisers when he found only 0.1 to 0.2 % of assimilable phosphoric acid. When the phosphoric acid soluble in citric acid reaches the figure of 0.3 %, the utility of these fertilisers ceases from the economic point of view. The utility of potash in an assimilable form continues up to 0.15 %; these methods indeed appear to agree in results with those obtained when fertilisers are applied to cultivated soils, provided the latter are not calcareous. DYER himself thinks that for these a larger quantity of citric acid is necessary so as to neutralise the carbonate of lime they contain. Further, for soils containing 15 to 20 % of carbonate of lime, which is not unusual, the method is uncertain in its results; the citrate of calcium formed, covers the seeds with carbonate of lime and limits its action; the evaporation and calcination which follow should also be taken into account.

These reasons induce the author to give up citric acid as a solvent and make a comparative study of the method, the principle of which was invented by TH. SCHLOESING Jun. and its technical application by DE SIGMOND. SCHLOESING divides phosphates into two distinct groups: those which are soluble in 0.5 % citric acid and those soluble in about 1 %. In the first of these groups, the phosphoric acid dissolved should belong to

phosphates with a calcium, magnesium and alkaline base, but not to those with an iron and aluminium base, which dissolve at an acidity of over 1 ‰. Soils from which the excess of phosphoric acid is separated with very weak acids are the same as those from which this excess is removed by water and other solutions with which they come contact. Hence it is concluded that this phosphoric acid belongs to the first group. DE SIGMOND confirms the existence of these two groups of phosphates, finding in 12 of the 14 kinds of soil examined that the quantity of phosphate dissolved, at acidities between 10 ‰ and 1 ‰ per unit of nitric acid, is invariable. In operating on 100 samples in which the need for phosphoric acid had been proved by experiment, he observed that though there is no constant connection between the total phosphoric acid content and the phosphate requirement of soils, there is a very close connection between the amount of phosphoric acid in an assimilable form and the need of a soil for phosphatic fertiliser.

The author adopts SIGMOND's method, applied in such a way that the final acidity is always between 200 and 1000 mg. per unit of nitric acid, and preferably about 500 mg. He uses a titrated solution of nitric acid of which 1 cc. = 100 mg. of nitric acid and a solution of potassium hydrate of which 1 cc. = 10 mg. of nitric acid.

In a large number of soils, more or less rich in carbonate of lime, the author, by using the official, DYER's and SCHLOESING's methods, also determines the quantity of assimilable potassium dissolved in nitric acid at a concentration of approximately 0.5 ‰. He gives two tables in which the soils are grouped according to increasing basic content which give an exact explanation of the two methods.

DYER's method gives a higher return of phosphoric acid than SCHLOESING-DE SIGMOND's, this being due to the fact that citric acid at 1 ‰ is a good solvent both of iron and aluminium phosphates and also of soil and alkaline soil phosphates in slight combination.

HALL and DEMOLON maintain that all the phosphate combinations found in soil appear to be represented in DYER's citric solution, for besides calcium there are organic matter and salts of iron and aluminium. A possible objection to DYER's method is that it is not easily applied to all soils, calcareous or otherwise, and that it dissolves iron and aluminium phosphates too easily, which phosphates are considered to have less easy access to plants than calcium and magnesium phosphates. This method, however, has been of great service in the analysis of silicious soils containing lime or clay.

The SCHLOESING-DE SIGMOND method has the advantage of rapid and easy application to non-calcareous soils as well as to those which are highly calcareous. It also appears to allow a better classification of soils which are to be treated with phosphate applications.

The relative assimilability however of the soil phosphates in slight combination, soluble in nitric acid at 0.5 ‰, and the more or less gelatinous iron and aluminium phosphates which are to be studied, should be borne in mind.

The quantities of assimilable potash separated are smaller than those of phosphoric acid, probably because potash enters into less varied combinations. The limits which show a poorness in the soil content of potash may be considered as being 0.20 ‰ by DYER'S method and 0.30 ‰ by SCHLOESING'S.

In conclusion, the author thinks that soil analysis limited to the study of its four principal elements is insufficient for fixing the phosphoric acid and especially the potash needs of the soil. He admits at the same time that the DYER and SCHLOESING-DE SIGMOND methods mark a great advance and are, together with the official method of determining by concentrated boiling acids, almost exclusively employed up to the present, of great help in these researches.

R. P.

920 - **Necessity for defining Soil Types in Investigations on Yield.** — BROWN, P. E (Professor of Soil Bacteriology, and Chief in Soil Chemistry and Bacteriology in the Experiment Station, Iowa State College, Ames, Iowa), in *Journal of the American Society of Agronomy*, Vol. 14, No. 5, pp. 198-206. Geneva, N. Y. May 1922.

Until comparatively recently there has been a tendency to make a general application of culture investigations, the results of which, on the contrary, apply only to the soil used. The numerous disagreements and contradictions in the results obtained by different investigators, and even by the same investigator, should be attributed in a great measure to the fact that conditions were different and above all that different soils were used. Many of the failures of farmers when applying these results to field work are due to this; hence the distrust in these experiments felt by practical men. Nevertheless, agriculture is greatly indebted to experimental work, which has proved of inestimable economical value and needs no apology.

Few of the results of experiments apply to *all* soils; generally, the particular soil type should be taken into account. Numerous investigators continue to ignore this essential feature. This is partly explained by the fact that they wish to make the best of their results by applying them generally; at the same time the farmers ask for advice which may be put into practice without difficulty and with the fewest possible restrictions. It should be remembered also that the experimental stations and scientific laboratories have a tendency to publish as much as possible and that the investigators desire to make themselves known early and to acquire honours, which blunts their critical sense and leaves their published work defective. There is a tendency to arrive at hasty and too generalised conclusions which leads to disillusion. Applications should be more specific.

Care should be taken however not to fall into the opposite extreme, as LIPMAN and LINHART have done, according to whom fertiliser tests are of very limited application, of no practical value and do not justify the expenditure of energy and money involved. This hypercritical attitude has no foundation; unfortunately it influences the uninitiated and brings discredit on soil experimental work in the minds of other scientists, farmers and co-operative societies.

What is of importance is to determine the soil type when making investigations. Once this is done there can be no question but that under the same conditions results on the whole will be similar. After a very long experience, the writer is convinced that the classification by the U. S. Bureau of Soils gives a sound definition of soil types. This classification includes several hundreds of types; in some cases even the distinctions are so fine that it is impossible to distinguish the types described and this involves too much of the personal equation. In spite of this defect however, it is fundamentally sound and offers a firm basis for scientific and practical men.

To prove the different reactions of dissimilar soils treated with the same fertiliser, the writer describes numerous field experiments carried out on 10 soils to which he applied 5 kinds of fertilisers and on which he cultivated oats, clover and maize, and also pot experiments on 9 soils treated in the same way and on which wheat and clover were grown. Certain fertilisers proved beneficial, though in varying degrees, to certain cultures on all the soils; thus, lime to clover and manure to maize and oats. Other treatments however gave very different results with the same crop on different soils. Thus, in a pot test, a complete fertiliser gave an increase of 60 % in clover yield over the control in one soil, and 900 % more in another. Different soils, therefore, may respond in a very different way to fertilisers and correctives. This fact is well known as regards sulphur, potassium, etc. The influence of fertilisers as regards the nitrogen content of tops and roots varies; that on bacteria also varies, and the author has made a special study of this question. Other investigations have been made by him to determine the relation between the soil type and its chemical composition.

L. V.

921 - **Relations between Soil Type and Root Form of Pine Seedlings.** — HAASTIS, P. W. (United States Forest Service) in *Ecology*, Vol. 2, No. 4, pp. 292-303, 3 figs., bibl. of 8 works. Brooklyn, Oct. 1921.

While studying the natural reproduction of *Pinus ponderosa scapularum* at the Fort Valley Station, Flagstaff (Arizona), the writer has been trying during the last two years to correlate the character of root development of the young seedlings with the types of soil. He has made a study of 286 plants divided into six age classes. The soils, almost all of basaltic origin, but some also composed of cinders (volcanic), were divided into five groups: 1) *Stony-clayey*, compact, stiff, but modified by stones and stony rocks; 2) *Gravelly-loamy*, light and moderately porous, not baking or crusting when dry and with a few stones (these two types are the most frequent in the area studied); 3) *Loamy-rocky*, mellow, dark-coloured, moderately rich in humus, with many stones (a little less common than the two foregoing); 4) *Clayey*, very compact, least porous, not well aerated, deep, retaining moisture and most fertile; 5) *Cindery*, loamy, porous, with coarse cinders below or in the middle (the least frequent). The roots, complete, with all their lateral rootlets, were divided into 8 categories: filiform (only met with in the first stage of growth), bifurcate,

muscoid, obconical (like an inverted cone), clavate, fusiform, cylindrical and ramified (without main root). The main roots may have one of these types. There is a special form of fan-like ramification. The most usual forms were obconical and cylindrical, next came the clavate and fusiform.

In clayey soils, lateral roots were scarce; they were more frequent in stony-clayey and gravelly soils, and abounded in loamy-rocky soils. In the coarse-cindery soils, the largest number of ramified roots were found; these were rather rare in the other soils, especially the clayey ones. The same was noted in the case of the fan-like ramifications.

In general, two extreme root growths were observed: one, in clayey soil, was characterised by a minimum number of laterals and by "branching"; the other, in coarse-cindery soils, by a maximum of laterals and branching.

The more clayey the soil, the longer is the root and the smaller the ratio between top and root; the more loamy the soil, the shorter the root and consequently the greater the above ratio. This had already been observed by WEAVER. It is not in direct relation with the available moisture of the soil and in fact tests have proved that the smallest quantity of available water was held by stony-clayey soils and the largest quantity by coarse-cindery soils.

L. V.

922 - **Influence of Irrigation on the Composition of the Soil.** — GREAVES, J. E. (Department of Chemistry and Bacteriology, Utah Agricultural Experiment Station, Logan), in *Journal of the American Society of Agronomy*, Vol. 14, No. 5, pp. 207-212, bibl. of 7 works. Geneva, N. Y. May 1922.

Water has a double action on the soil. It assists or hinders the normal development of the processes in the soil, and its most manifest influence is over the process of nitrification, of which the maximum is attained when the soil contains 60 % of its water-holding capacity. Above or below this concentration, there is a decrease; and nitrification ceases when the quantity of water reaches or exceeds 90 %. As regards nitrification, therefore, an excess of water is more detrimental than an insufficiency. Under good moisture conditions, from 50 to 100 lb. of nitric acid may be produced in an acre of soil during a season; it is a well-known fact that this acid is of great assistance in the liberation of phosphorus and potassium. The moisture content acts similarly, but in a less degree, on ammonification, the maximum production of which is also reached when the soil contains 60 % of its total water-holding capacity. All the other processes which take place in the soil are also dependent on its water content: for instance, the production of carbonic acid gas, which may be as much as 60 l. per acre per day; it also plays an important part in the solution of tricalcium phosphate. Finally, it influences the production of lactic, acetic, butyric, sulphuric, and other acids, which help to dissolve potassium, etc.

The other fundamental action of irrigation water is that it brings or carries away plant food; it impoverishes or enriches the soil. To gain an idea of the enormous quantities of substances that water may carry

off from the soil, it is only necessary to consider the constituents of river water. The substances in solution such as for instance, sodium chloride are not generally of any importance in agriculture, but useful substances, such as potassium, nitrogen and phosphorus, are not lacking. The writer describes certain analyses on this question. Some irrigation drain waters are still richer; certain of them contained as much as 133 pounds per acrefoot.

When irrigation is carried out properly, the water, as it evaporates, deposits the substances it contains, as in the case of the Nile. Thus, in Utah, the waters used for irrigation contain 0.79 to 59.0 parts of potassium per million, or an average of 5 parts which may be used by the soil. Irrigation waters contain besides potassium, nitrogen and other useful soluble substances; they are therefore capable of improving the soil. The great point is to irrigate *in moderation* in order not to *wash out* the soil. Irrigation may transform the desert into a garden or render the most productive fields barren, according as it is well or ill done. L. V.

**METHODS  
OF  
CULTIVATION**

923 — **The Culture of Cereals in Furrows.** — CHAPLIN, M. S., in *La Gazette Agricole du Canada*, Vol. IX, No. 2, pp 120-125. Ottawa, Mai-Avr. 1922

The development of Saskatchewan is due to its wheat and oat production. To keep the soil moist and destroy weeds, the farmers let the land lie fallow once every two, three or four years, according to local conditions of soil and climate. This system generally gave good results in the different districts so long as land was cheap and the selling price of wheat and other cereals comparatively high; also provided the soil kept its original firmness sufficiently to prevent the plants being lifted by the wind.

At the present time certain factors compel the Prairie farmers to modify this system.

It would be difficult to say which is the chief among these factors, but each of them has an influence.

In many districts, trouble is caused by dust storms. Fallow land is exposed to the weather the whole year round and there is consequently a displacement of soil. The effects of the dust storms are so evident that it is needless to allude to this point (1).

The market prices of cereals are no longer maintained at the high level due to the war. Means must be found for producing at prices sufficiently low to compete with other countries in the world markets.

In certain districts the price of land has risen to such an extent that the interest and taxes on an acre of fallow-land have become a considerable burden, eliminating all hope of profit on wheat production, even when they do not show a loss.

This being so, it is clear that at the present stage of development in Canadian agriculture, all crops cultivated in furrows which can replace at least a part of fallow-land will be considered useful. Some farmers

(1) See R. Feb. 1922, No. 143. (Ed.)



are trying maize, others potatoes. These crops are useful over a very limited area, but something must be found which can be cultivated extensively so as to replace a considerable part of the present fallow-land.

Guided by previous experience the author has decided to carry out experiments at Saskatchewan to see if grain culture in furrows can replace the fallow-land.

Some preliminary experiments were made in 1921. The plots on which they were carried out were rather large, measuring 0.4 acres each and gave very encouraging results. Trials were made with wheat, oats and barley. Each crop was sown in groups of 3 rows, with 30 inches distance between each group and in groups of 2 with 36 in. between them. For comparison, a table is given showing the yields from both methods of the first and second crop after the land had been lying in fallow during the summer. The grain in furrows was sown on soil which had borne oats the previous year, 1920, and various crops in 1919, and had not lain fallow in 1918. The following is the grain and straw yield in kg. per ha.

Method of sowing	Grain Kg.	Straw Kg.
<i>« Marquis » wheat.</i>		
Ordinary on fallow land . . . . .	42	4.10
Ordinary on Autumn tillage . . . . .	42	3.67
Double rows with 91 cm. between . . . . .	20.95	1.07
Triple rows with 76 cm. between . . . . .	25.02	1.27
<i>« Banner » Oats.</i>		
Ordinary on fallow land . . . . .	94.55	5.90
Ordinary on Autumn tillage . . . . .	67.95	3.07
Double rows with 91 cm. between . . . . .	67.47	0.85
Triple rows with 76 cm. between . . . . .	72.35	1.07
<i>« Hannchen » Barley.</i>		
Ordinary on fallow land . . . . .	67.02	3.62
Ordinary on Autumn tillage . . . . .	63.97	2.77
Double rows with 91 cm. between . . . . .	42.27	0.63
Tripled rows with 76 cm. between . . . . .	55.92	0.80

The Department of Animal Industry has also sown oats in furrows as pasture, to replace summer fallow, with very satisfactory results.

F. S.

924 - **The Sowing of Seeds and Scattering of Chemical Fertilisers simultaneously in parallel and close Lines.** — BANDRY, A., in *Comptes Rendus des séances de l'Académie d'agriculture de France*, Vol. 8, No. 20, pp. 574-580. Paris, 1922.

Low crop yield is due less to the insufficiency of chemical fertilisers used than to their imperfect utilisation by the crops. It was decided to place within immediate reach of the young plants the mineral nutriment needed by them from the earliest stages of their growth. For 15 conse-

cutive years the author studied the application to extensive cultures of the simultaneous scattering of chemical fertiliser and seed grain in close parallel lines. The results obtained are as follows :

1) The maximum profit in practice from crops, both of cereals and pulse, has always been obtained by using quantities of chemical fertilisers varying from 300 to 400 kg. per ha.

2) With more than 400 kg. of chemical fertiliser the value of the increase in weight of the crops did not correspond with that of the increase in weight of the chemical fertilisers used.

3) The yield per ha. of useful dry matter from the crops obtained by using 200 to 400 kg. of chemical fertilisers spread in lines has been at least equal and often superior to that obtained on the same soil by using 600 to 1000 kg. of the same fertilisers distributed in the usual way.

4) Chemical fertilisers sown in lines at a depth of 2 to 3 cm. in close proximity to the seed have a beneficial effect on the young plants.

The author concludes that this method of rational utilisation of chemical fertilisers is so effective that it has become possible to reduce the quantities hitherto judged necessary to ensure the maximum practical profit from crops by 50 to 60 %.

S. F.

**925 - Thirty Years of Field Experiments with Crop Rotation, Manure and Fertilisers. --**

MILLER, M. F., and HUDLSON, R. R., in *Missouri Agricultural Experiment Station Bulletin*, No 182, pp. 1-43. Columbia, Missouri, April 1921.

The author proposed to ascertain the effects of crop rotation and continuous cropping upon unmanured and manured soil respectively. They realised that experiments over a long period are necessary in order to reduce to a minimum the influence of seasonal variation and to secure reliable results from the various rotations.

The data here reported include the results of 30 years experiments (1888-1918) with different systems of crops, manures and fertilisers, designed to ascertain not only the effect upon crop yields, but also upon the soil.

The soil of the experiment field was a silt loam of a dark brownish grey colour, the surface drainage was generally good and the soil fairly uniform in fertility. The field was divided into 39 tenth-acre plots at first, though these were afterwards reduced to one-thirteenth acre and subsequently to one-fourteenth acre. The plots were planted with continuous crops and rotations of maize, oats, wheat, clover and timothy.

These crops were grown at the same time on untreated plots, on plots given manure, plots given chemical fertilisers such as nitrate of soda, muriate of potash and superphosphate, as well as on plots receiving both manure and fertilisers.

The applications of manure were much larger than is usual on the average farm (7-9 tons per acre); hence the effects upon the soil and crops were intensified, but weed growth was encouraged so that the grass and clover crops sown with the crops were smothered, and lodging was induced in wheat and oats.

The fertiliser treatment was based on the quantitative chemical analyses of the crops, the different elements being added in the same proportions that they were removed in maximum crops. The plot on which wheat was continuously grown received sufficient nitrogen, phosphorus and potassium to equal the amounts contained in a 40-bushel wheat crop and the accompanying straw.

From the experimental data collected by the authors it appears that :

1) *on untreated soil*, rotation gave very superior results to continuous cropping. In the case of maize, the yield is increased by lengthening the period between the crops, as is shown by the following figures :

20.9	bushels with continuous cropping
32.6	" " 3 years rotation
38.5	" " 4 " "
41.5	" " 6 " "

In the case of the other crops, the maximum yield is obtained from 4 years rotation.

In the opinion of the authors, the low yield obtained by continuous cropping is due to several factors among which are insect enemies, weeds and disease, which are all favoured by growing the same crop on the same field year after year.

2) *On soil treated with manure* so as to maintain its fertility, rotation gave better results than continuous cropping, although the differences in the yields of the various crops were not so great as in the case of the experiments carried out on unmanured soil.

The use of manure greatly increased the yield of continuous crops, especially in the cases of maize, wheat and oats, the average increase recorded being as follows :

Maize	14.0	bushels per annum per acre
Oats	10.1	" " " " "
Wheat	8.6	" " " " "
Clover	827	lb. " " " "
Timothy	2325	lb. " " " "

The above figures show the high value of manure on wheat, maize and timothy, the effect on continuous clover not being so good.

In the course of the long experiment period, it was found that a three-year rotation on an unmanured soil gives lower yields than are obtained from continuous crops on manured ground, whereas with a long rotation (4-6 years), better results are obtained than from continuous crops grown on manured soil. Judging from the soil analysis, it is evident however that manure is more effective than rotation in maintaining the fertility of the soil. In fact, although by means of careful rotation it is possible to some extent, to relieve soil exhaustion all the elements required cannot be supplied by this means. A combination of rotation and manure is best.

3) *On soils treated with chemical fertilisers* the yield of the crops was

kept up as well as when manure was used. On comparing the different results obtained it is seen that maize does better with manure, but wheat and oats are better with fertiliser. In general, this relative response of the different crops to manure and fertiliser agrees with the results of numerous other experiments made at the Missouri Experiment Station and at the Rothamsted Experiment Station in England, and the Pennsylvania Experiment Station.

Chemical fertilisers, especially phosphates, are particularly to be recommended for wheat.

In the case of plots receiving fertilisers only, even in the one cropped continuously with wheat the soil was not appreciably more compact than that of similarly cropped plots without treatment, contrary to the generally received opinion that large quantities of sodium nitrate tend to deteriorate the soil texture.

4) *On soil treated with half manure and half fertiliser*, better results were obtained than with chemical fertilisers alone; therefore mixed fertilisers are the best to employ as they also maintain the soil fertility. To determine the effect exerted on the soil by different methods of cropping, the authors had recourse to chemical analysis. At the end of 25 years samples were removed from the different plots and the nitrogen content was taken as an indicator of the amount of organic matter in the soil. Maize was found to be the most exhaustive crop as regards the nitrogen, after which come oats and wheat. Timothy appears to exhaust the soil least. As a rule, rotations are less exhaustive of soil nitrogen than any single crop. This may be due to nitrogen fixation by bacterial agency.

Chemical fertilisers, even when used in large quantities, did not keep up the soil nitrogen. Evidently most of the nitrogen not immediately used by the crop was removed by leaching, or denitrification. Manure on the other hand proved very effective in maintaining the nitrogen supply.

This long series of experiments proved that, in general, *crop rotation gives better results than continuous crops*. Among the rotations used the four-year rotation of maize, oats, wheat and clover gave somewhat better results than the others. In order to obtain good crops the soil must also be manured. As a rule, farmyard-manure and chemical fertilisers proved of about the same value from the point of view of crop yield, but farmyard-manure was more effective in maintaining the fertility of the soil.

The application of a mixed fertiliser has proved to be the best method to maintain heavy crop yields without exhaustion of the land. L. M.

926 - **Relation between Nitrogen in the Soil and Livestock Farming.** — WILLIAMS, C. (Director of the Agricultural Experiment Station, Wooster, Ohio), in *Journal of the American Society of Agronomy*, Vol. 14, No. 5, pp. 159-162. Geneva, N. Y., May 1922.

Since 1910 the writer, has been making comparative experiments at the Station which he directs, in livestock farming and the direct utilisation of the various crops. The rotation followed is maize, soybeans, wheat and clover. Each area receives 2 tons of ground limestone and 700 pounds of 16 % acid phosphate per acre, per rotation. In the first system, all

the crops except wheat are fed to livestock or passed into the manure as bedding and the manure is applied to the maize crop ; in the second, the maize, soybeans and wheat are removed and sold, the hay and straw being left upon or returned to the land ; and the clover is not harvested, but allowed to stand until ploughed under the following spring. The comparison shows the superiority of livestock farming, which increases the crop production and the nitrogen content of the soil. L. V.

927 — **Fertilisers in Indo-China.** — MANGIN, L., in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. 7, No. 37, pp 794-803. Paris, Nov. 30, 1921.

MANURES  
AND  
MANURING

The author, acting for the Economic Agency of Indo-China states that this country has imported very little chemical fertiliser up to the present. In 1913 not more than 3 419 qx. were imported, including chloride of potash, nitrate of soda, nitrate of potash, superphosphates and other fertilisers. During the war the quantity was still lower. In 1920 the Central Government had 433 tons of potassic fertilisers sent from Alsace on account of several planters' associations.

With the progress made in agriculture, the use of chemical fertilisers, based on a knowledge of the chemical composition of the soil and the necessary fertilising elements, will doubtless become more extended.

The Central Government has had analyses and enquiries made in the countries of the Union of Further India (" Union Indo-Chinoise ") in order to ascertain the sources of fertilising matter in each district, their need of fertilisers and the most effective way in which to extend their use. The results of the enquiries are as follows :

*Cochinchina.* — Without taking into consideration farmyard manure, the fertilisers from local sources are : silk-worm waste, bat guano, fish offal and the remains of fish and crustacea left over from the manufacture of *Nouc-mam*, a kind of pickle used as seasoning, arachis oil-cake, copra, sesame, castor-oil, etc., barley waste from the distilleries and waste from the rice-crushing mills.

The Works of the Indo-Chinese Distillery Co at Cholon can produce 2000 kg. of dry barley waste, phosphated or otherwise, daily.

M. VIEILLARD, Inspector of the Agricultural Services, has classified the soils of this country from the chemical point of view as follows :

- 1) Alluvial marine soil of old or recent formation ;
- 2) Alluminous soils ;
- 3) Alluvial soils from the valleys ;
- 4) Grey soils ;
- 5) Red soils.

Natural phosphates may be applied to nearly all the soils of Cochinchina except the red earths.

Mineral superphosphates, bone superphosphates and basic slag might be imported from France, but in most cases the natural phosphates of Tonkin and Cambodia will also be effective and cheaper.

*Cambodia.* — This country up to the present has only imported crab fertiliser for pear culture. The amount imported annually may be

estimated at 1000 to 2000 tons, of which the greater part comes from the Malayan Archipelago and the Province of Bach-Cia, in Cochinchina and a small part of South Annam. With this exception, the natives use no fertilisers and consider the periodical inundations sufficient. In other districts, owing to the sparse population, they burn the bush and forests in order to improve the land temporarily, repeating this operation over more distant areas, to the great detriment of the forest resources of the country.

Agriculture, as it develops, will find in Cambodia itself phosphates as rich as those of Tonkin, and the fish offal of the great lakes and the Mékong, which at present is wasted, would supply fertilisers rich in nitrogen and phosphoric acid. For the cultivation of crops for which large concessions have already been asked and obtained, the fertilisers imported will be of the same kind as those for Cochinchina, especially in the case of red and grey soils, which cover millions of hectares in Cambodia.

*Annam.* -- The fertilisers from local sources, in addition to farmyard manure, are the waste products of copra, of *Candlia* and *Calophyllum* from domestic presses in the different provinces, and cinders from factories and works used in tobacco and coffee culture. With the exception of a small quantity of phosphate imported from Tonkin, the natives as yet only use these local fertilisers. There is no doubt however that the use of chemical fertilisers, would cause a remarkable increase in many crops in Annam.

*Tonkin* -- The Works of the Indo-Chinese Distillery Co. can produce from 1200 to 1500 kg. of distillery refuse, phosphated or otherwise. This is in excess of the present demand.

There are numerous beds of natural phosphates worked by the Tonkin Phosphate Co. In 1920 this company manufactured more than 7000 tons. The greater part is used in Tonkin itself; a small quantity, less than 500 tons, was exported to Cochinchina, Annam, China, the Dutch Indies, and Siam. Consequently the planters of this country appreciate the advantage of replacing farmyard manure largely by chemical fertilisers, the production of the manure requires considerable capital and is uncertain on account of frequent outbreaks of disease amongst animals. In addition to the local phosphates, potash and nitrate fertilisers should be used. Such are: nitrates, sulphate of ammonia and cyanamide, especially for valuable crops such as tea, coffee and tobacco. They would always command a high price owing to the greater yield they produce.

*Laos.* -- Owing to the sparse population, the extent of uncultivated land and the backward state of civilization the question of fertilisers in this country has not yet been considered.

The Economic Agency of Further India suggests the following measures for extending the use of chemical fertilisers:

- 1) Comparative experiments at the Experimental Stations of the Economic and Agricultural Departments,
- 2) Posters in the languages known and spoken in the country: French and Quongu, and in Chinese characters;

3) Instruction in the schools and discussions after the school period.

M. DEVRAICHE, Chief of the Economic Department of Cochinchina advises the Agricultural Syndicates to sell fertilisers at very low prices, even at a loss at first if necessary.

The Chamber of Agriculture for Cochinchina thinks that the best propaganda would be the gratuitous distribution to the principal villages of a sufficient quantity of the fertilisers applicable to the intended cultures.

Finally, M. VIRILLARD proposes the sale of compound fertilisers, mixed and ready for use, for tobacco, rice, the sugar-cane, etc.; these fertilisers should be prepared by specialists and adapted to the intended cultures and the soil.

The application of these measures of propaganda in favour of the use of chemical fertilisers would give a considerable impetus to agriculture in Further India.

R. P.

928 - **Thirty Years of Field Experiments with Crop Rotation, Manures and Fertilisers.** - See No. 925 of this *Review*

929 - **The Sowing of Seeds and Scattering of Chemical Fertilisers simultaneously in parallel and close Lines.** - See No. 924 of this *Review*

930 - **Effect of Organic Material on Plant Assimilation.** - See No. 931 of this *Review*.

931 - **The Relation between Organic Matter and the Assimilation of Mineral Phosphate.** - BAUER, J. C. (Agricultural Experiment Station, University of Wisconsin), in *Soil Science*, Vol. XII, No. 1, pp. 21-41, bibliography of 45 works. Baltimore, July 1921

The use of mineral phosphate in conjunction with organic matter in a state of decomposition has been recommended, as it is considered that organic, nitric and carbonic acids present in the decomposing matter attack the phosphates and render them more available. This view however was not upheld by the laboratory experiments carried out for its confirmation. Although in practical farming, phosphates give the best results when associated with large quantities of organic substances, when chemical methods are used, it does not seem possible to prove that the phosphates themselves are actually rendered soluble to any appreciable extent, and various attempts have been made to explain this contradiction.

TROUG was of opinion that phosphates when first precipitated in the soil in the form of very small particles are protected by a film of organic matter; TOTTINGHAM and HOFFMAN held the view that most of the phosphorus made soluble is utilised and organised by bacteria in such a way as to escape analysis. On the other hand many investigators have shown that plants possess to a greater or less degree the capacity of utilising insoluble phosphates. As a rule cereals are less capable than leguminosae, crucifers and buckwheat which can make great use of insoluble phosphate. This has been attributed to the secretion of organic and carbonic acids by the roots. CHIRIKOV has shown that plants which possess this capacity assimilate lime readily and TROUG considers that the quantity of lime contained in plants is related to the property of assimilating insoluble

phosphate. It would be advisable to have recourse to these plants in order to render the insoluble phosphates available.

The author suggests that in laboratory experiments up to the present time, carried out on mixtures of insoluble phosphate and organic matter in a state of decomposition, enough care had not been taken to remove at the moment of its formation any soluble phosphate of lime; as soon as the chemical equilibrium is established the reaction ceases and in consequence only very small quantities of phosphorus and lime are made soluble. On the other hand plants remove them in proportion as they are produced; in consequence the chemical reaction continues so long as there is complete utilisation of the phosphorus.

The author has carried out various experiments with a view to the continuous production of soluble compounds of phosphorus and lime. The experiments were made in pots filled with sand, or an acid sandy soil containing little phosphorus (0.59 parts per million); the decomposing organic matter employed consisted of melilot or buckwheat hay to which was added finely powdered mineral phosphate. On the supposition that soluble phosphate of lime would be formed he arranged for its removal by means of lixiviation with water and by capillarity methods so that the water in the lower layers was constantly renewed while evaporation was taking place on the surface. He also tested the action on mineral phosphate of decomposing plant extracts and of extracts from soil vegetable matter. It is unnecessary to remark that controls were not overlooked.

The author was unable to prove that organic matter in a state of decomposition had any effect in dissolving mineral phosphate.

The non-success of the preliminary experiments led the author to conclude that the acids produced by the organic matter were sufficient only to combine with bases found in the soil, which prevented their having any action on the phosphates. However, as shown by TOTTINGHAM and HOFFMAN, as soon as a small quantity of soluble phosphorus is produced it can be utilised by bacteria. This explains the negative results of the analysis. As the available data relating to chemical resources were not sufficient to explain the action of decomposing organic matter on insoluble phosphates, the author wished to make a thorough investigation as to the capacity of plants to make use of these phosphates in the presence of such organic substances. He arranged a series of cultures of maize in pots filled with sand to which were added different quantities of organic matter derived from lucerne, buckwheat or oat straw, together with mineral phosphate and with or without lime. The organic substances had a prejudicial effect on the growth of the maize and introduced complications, but the effect was very small in the presence of lime. In every instance, except in the case of the oat straw, the cultures were so poor that the experiment had to be abandoned.

In spite of this detrimental influence the actual growth of the maize was more vigorous in the pots containing both organic matter and phosphates than in those which contained an equal quantity of one or the



other only of these substances. An examination was made as to the weight of dry matter present which showed conclusively that the maize had been able to take advantage of the phosphates in those cases where the phosphates were mixed with decomposing organic matter, which confirms the experimental data. The author has proved by a number of analyses the presence of a high percentage of phosphorus and lime, both soluble and insoluble, in maize and other plants.

In order to explain the way in which plants utilise mineral phosphate in the presence of organic matter in a state of decomposition, the author suggests two theories: 1) the acids derived from the organic matter are able to dissolve the phosphate, or 2) the plants themselves are able by some means to effect its solution.

In order to study the power which plants may possess to dissolve mineral phosphate without the cooperation of organic matter the author carried out a series of cultures with 15 plants in sand to which was added mineral phosphate or superphosphate, with or without lime and a further number of controls without any additions. The results have shown that plants are able to some extent to make direct use of basic phosphate, but in a less degree than soluble phosphate. In this respect melilot showed the greatest capacity as its coefficient of utilisation reached 83 % as compared with soluble phosphate. The roots of the plants which had to utilise basic phosphate were generally better developed if lime was present. This fact explains how under such conditions plants become more energetic in order to obtain the phosphorus which they need.

The only exception was melilot which was able to absorb insoluble phosphorus without any further development of its root system.

No connection has been recognised between the amount of phosphorus contained in plants grown in the presence of soluble or insoluble phosphate and the acidity of their sap or their different parts. Neither has it been possible to find any definite relation between the lime content of plants and their capacity to utilise insoluble phosphate.

The author then attempted to test the capacity of plants for the absorption of another insoluble mineral element, namely, potassium as contained in feldspar. It is not understood how this absorption is effected, but in this case it is certain that the lime contained in the plant does not assist the reaction.

The experiments were made on four plants only, viz. buckwheat, which can make good use of insoluble phosphate with a capacity of 72.1% as compared with soluble phosphate, but was only able to absorb a small quantity of insoluble potassium, 23.3 % as compared with potassium sulphate. On the other hand, oats which have only a relative capacity to utilise 41.5 % of insoluble phosphate, absorb potassium from feldspar to the extent of 107.6 %, a contrast which even the different development of the root systems does not explain. Buckwheat is similar to maize, but melilot which can use 83 % of insoluble phosphate, relative to soluble phosphate, has in the case of potassium from feldspar a capacity of 106.5 %. In the last experiment melilot grew extraordinarily well in a mixture compos-

ed exclusively of siliceous sand, feldspar, mineral phosphate and lime, moistened with distilled water; maize on the contrary made very poor progress.

There are many nutritious plants similar to melilot, maize and buckwheat. Melilot possesses the greatest capacity for dissolving mineral phosphate and feldspar in order to utilise the mineral matter in the production of organic substances.

The problem of the rotation of cereals with plants of this order is very important from a practical standpoint, as such plants are able to supply nitrogen, and to assimilate phosphorus and potassium from comparatively insoluble minerals.

L. V.

932 - **The Availability of Potash in some Soil-Forming Minerals.** — FRAPS, G. S., in *Texas Agricultural Experiment Station Bulletin*, No 284, pp. 5-16, figs. 3. College Station, Brazos County, Texas, December 1921.

The availability of the potash in biotite, muscovite, orthoclase, microcline and many other mineral constituents of the soil is a matter of great importance to soil chemistry. It is particularly interesting to know whether there is any relation between the solubility of these minerals in acid and the amount of potash they can supply to plants.

With a view to solving this question and with the special object of testing the effect of granite which had been proposed as a fertiliser for Texas soils, the author carried out three series of experiments. In the two first series he studied the general problem, but in the third he confined himself to the study of the fertilising effect of granite.

In the first series of experiments, only 500 parts of potash were used per million parts of soil, in the second series the amount of mineral potash added was 4000 parts per million of soil.

Nitrogen and phosphoric acid, in the form of nitrate of soda, or of ammonia, and superphosphate were used in both the above experiments, and in two sub-series, carbonate of lime and sawdust were added respectively

Pots were used throughout the experiments and as in no case was any potash applied except in mineral form, the amount of potash removed from the soil by the different crops can be measured from the quantity taken from the minerals. A large number of minerals were employed in these experiments including microcline, orthoclase, biotite, muscovite, leucite, nephelite, pinite, stilbite and chabazite, and they were compared with sulphate of potash. Cotton, maize, millet and sorghum were planted in the pots, the sowing being so arranged as to obtain 4 crops.

The tables given by the author give the results obtained in the two first series of experiments. The average amount of potash removed from the soil by the crops of the first series varied from 1 % (microcline) to 38.7 % (sulphate of potash). The different substances used may be placed in the following ascending order: microcline, orthoclase, pinite, muscovite, biotite, stilbite, chabazite and sulphate of potash. The largest recovery of potash was usually made with the first crop. The results obtained with leucite and nephelite were not satisfactory, but probably, as the author suggests, this was due to the small number of experiments.

The relation between the availability of the potash and the different minerals and their solubility in acids may be ascertained by noting: the amount of potash present in each mineral, the percentage of potash dissolved by fifth-normal nitric acid, and the percentage of potash removed by each crop. These data are to be found in the following Table.

*Relation of Average Potash removed by One Crop to Total and Active Potash of Minerals.*

	Micro- cline	Ortho- clase	Musco- vite	Phlute	Biotite	Stilbite	Nephe- lite	Sul- phate of potash
Total potash % . . . . .	10.14	11.81	10.20	5.80	9.62	0.28	2.86	50.04
% total potash soluble in N/5 nitric acid . . . . .	0.9	1.1	17.1	5.4	26.4	34.00	49.3	100
% total potash removed per crop (1st series) . . . . .	1.0	3.8	11.1	—	13.2	—	7.4	38.7
% total potash removed per crop (2nd series) . . . . .	0.7	1.2	7.5	1.6	11.2	13.6	—	32.9
% available potash remov- ed per crop (1st series). . . . .	110	350	70	—	52	—	15	39
% available potash remov- ed per crop (2nd series). . . . .	80	110	60	30	45	40	—	33

The amounts of potash taken by one crop from microcline average the same as the quantity dissolved by fifth-normal nitric acid. The amount utilised from orthoclase is somewhat more than that dissolved by the acid, the relation varying from 1.1 to 5.5. One crop removed from muscovite on an average 30 to 70 per cent of the potash dissolved by fifth-normal acid, from biotite 30 to 50, from stilbite 40 and from sulphate of potash 20, 30, 40 per cent.

In the third experiment, maize and sorghum were grown in pots containing different kinds of soil to which was added granite containing 4.94 % total phosphate.

At the same time, and under similar conditions, other experiments were made in which some of the pots received no fertiliser, while others were given a complete fertiliser (ammonium nitrate, dicalcium phosphate and sulphate of potash).

The results of these experiments showed that granite has little or no effect as a fertiliser owing to the insolubility of the contained potash.

The author carried further the researches of other investigators especially those of J. K. PLUMMER (*Journal of Agricultural Research*, XIV, No. 298, 1918), and proved that the potash removed by crops in the presence of nitrogen and phosphoric acid is related to its solubility in fifth-normal nitric acid.

Minerals which contain potash easily soluble in strong hydrochloric

acid give up their potash more readily to plants than those containing potash less soluble in strong acids.

The results the author obtained as to the non-fertilising effect of granite are in complete agreement with those already published by HARTWELL and PEMBER (*Rhode Island Experiment Station, Bulletin* 129).

933 - **Potassium Nitrate Ratio of Red Clover as influenced by Potassic Fertilisers.** —

EMERSON, P., and BARTON, J. (Assistant Professor of Soils and Assistant in Soils, Iowa State College, Ames) in *Journal of the American Society of Agronomy*, Vol. 14, No. 5, pp. 182-192, bibliography of 17 works. Geneva, N. Y. May 1922.

The most important question before soil investigators to-day is to obtain maximum crops by means of a practical method of manuring. Excessive application would lead to waste. Attention should also be given to the fact that crops may be stimulated to such an extent that the soil is impoverished by loss of its constituents, which will undoubtedly have an effect on fertility during the following years. Very little is known as regards the specific physiological effect played by each mineral element in plant nutrition. It is recognised, however, that absorption may vary to a considerable extent. Potassium is, for example, indispensable, but the amount of absorption is variable as has been proved by several investigations. Beyond a certain limit it is doubtful whether the potassium is used (HALL), or whether it is only tolerated (HOPKINS and AUMER). The authors have undertaken pot-culture tests with red clover to investigate the potassium absorption question. To silt loam were added various potassium salts, viz. potassium chloride, potassium sulphate or kainit at the rate of 100 lb. and 400 lb. per acre, lime was applied at the rate of 4  $\frac{1}{2}$  tons per acre (double the lime requirement by the TRUEOG method). In most cases, manure or superphosphate was applied, separately or together. The solubility of potassium increased with applications of chloride, sulphate and kainit. The kainit had also a beneficial effect on plant growth. Applications of lime had practically no effect on the solubility of potassium, but may stimulate nitrate production and consequently plant growth. The potassium absorption increases only in relation to the stimulated growth but taken as a whole the potassium nitrate ratio is reduced from 1 : 5.6 to 1 : 3.5. Applications of manure or phosphates, separately or together, increased the potassium solubility, but there is no corresponding increase in nitrate solubility. Manure has a depressing effect ; the ratio is therefore still further narrowed.

A combination of superphosphate, potassium sulphate and lime produced the maximum effect ; further addition of manure reduced the yield.

L. V.

934 - **Supplies of Nitrogen Fertilisers.** — HASKELL, S. B. (Director, Agricultural Experiment Station, Amherst, Massachusetts), in *Journal of the American Society of Agronomy*, Vol. 14, No. 5, pp. 167-175. Geneva, N. Y., May 1922 (1).

A comparison of the data collected for 1918 with that of other years, has led the author to estimate that approximately one-half of the total

(1) See R. Feb. 1922, No. 144. (Ed.)

supply of fertiliser nitrogen is derived from organic sources and the remaining half from mineral products. There is a tendency, however, for the consumption of organic nitrogen to decrease and that of mineral nitrogen to increase. Cottonseed meal supplies less than one-fourth of the fertiliser nitrogen, which would be better used as a livestock feed which should be encouraged. Dried blood, leather waste, tankage (coming partly from Argentina), fish by-products etc. are other sources of nitrogen.

Five-eighths of the mineral nitrogen fertiliser is furnished by nitrate of soda; the importation is on the decrease, and some solution must be found.

The remainder is supplied from cyanamide and sulphate of ammonia etc. The cyanamide is obtained chiefly in Canada, from the American plant which uses the Niagara Falls as a source of power.

The great bulk of the sulphate of ammonia is derived from the by-product of the coke ovens. The consumption of by-products is continually on the increase. The author strongly recommends a more systematic use of available resources

L. V.

935 - **Effect of Nitrates on the various Stages of Wheat Development.** — See No 947 of this Review.

936 - **The Manufacture of Nitrates by the Biochemical Oxidization of Salts of Ammonia.** — BOULLANGER, E., in *Annales de l'Institut Pasteur*, Vol. 36, No. 4, pp. 305-338, 1 fig. Paris, April 1922

The author had already experimented in the laboratory on the nitrification of sulphate of ammonia in solution, to which he added carbonate of lime in suspension; with this liquid he sprinkled peat or pozzolana impregnated with nitrifying bacterial cultures and obtained nitrate of lime and of gypsum. He also successfully used a solution of carbonate of ammonia (mono- and bi-) (1).

After these preliminary tests he has now made a semi-industrial attempt at production on a large scale with 9 masonry containers, each of about 800 litres capacity, and has found that the use of carbonate of ammonia is preferable in order to avoid the formation of gypsum which obstructs the process. The author describes these tests in detail. They have not however any economical value for the trade price of nitric nitrogen is the same as that of ammoniacal nitrogen, whereas the author produces it from the latter, making it bear the total cost of production (including the cost of evaporating the liquid by heating) as well as the cost of sinking fund and the inevitable loss of nitrogen. This is therefore an anti-economical process and might have been of value only during the war, when the author began these tests and when nitrates were necessary for war industries; during the war, this aspect was ignored and economy did not receive special attention. Today there is not a sufficient quantity of carbonate of ammonia on the market to supply an industry of this kind on a large scale. The process might be rendered practicable by using ammonia in combination.

L. V.

(1) See R. December 1921, No. 1204.

- 937 - **Notes on the Composition and Stabilisation of Ammonium Nitrate in Presence of Oxidisable Material.** — FINDLAY, A., and ROSEBOURNE, C., in *Chemical Industry*, Vol 41, No 4

A report of experiments made on the decomposition of ammonium nitrate, in presence of oxidisable material and possible methods of retardation. Decomposition takes place at temperatures much below the normal decomposition temperature of salt. Owing to the extensive use of ammonium nitrate, the question of retardation is highly important.

A water bath at 100° C was employed, and a reaction mixture of nitrate of soda and woodmeal. The gaseous products of decomposition were measured and analysed daily.

The gases given off consisted almost entirely of carbon dioxide and nitrogen, only rarely a small percentage of carbon monoxide was evolved.

The water condensed during the experiment was neutral to methyl orange, which proved the absence of acid oxides of nitrogen from the gaseous products of decomposition. According to the authors it is highly probable that decomposition is brought about by the nitric acid formed by the hydrolysis of ammonium nitrate, and that oxidation is accelerated by traces of nitrous acid. Following these lines, it was expected that the addition of carbamide would retard oxidation by destroying the nitrous acid and experiment shewed that carbamide is an effective stabiliser of ammonium nitrate.

Diphenylamine and phenyl benzyl ether have also been tested as stabilisers but have not given satisfactory results. L. M.

- 938 - **The Function of Manganese Fertilisers.** — In a report by BOCHER, H., Member of the Higher Council on Agriculture at the Agricultural Academy of France ('Membre du Conseil Supérieur d'Agriculture à l'Académie d'Agriculture de France'), sent by M. LOUIS DOP, French Delegate Vice President of the International Institute of Agriculture.

It may be said that today no farmer is ignorant of the action of manganese fertilisers, and also that among scientists few know the function and value of salts of manganese in agriculture. Nevertheless, everyone has heard of the manganese fertilisers placed on the market in 1910 by a commercial firm who advertised them widely. They were also well known after the long and minute researches made by M. BRÉTRAND, Professor at the Sorbonne and Pasteur Institute, who proved the following facts:

- 1) Plants need manganese for the development of their cells;
- 2) Manganese is a catalytic substance and a soil fertiliser.

M. PICARD of Paris in 1898 also pointed out to the Academy of Science (*Académie des Sciences*) the presence of manganese in the greater number of plants and proved its very important physiological function, especially at the beginning of plant life, at the moment of germination and early growth. M. GRANDLAU, Chief Inspector of Agronomical Stations, had also observed that manganese exists in all plants and that its presence seems necessary to plant growth. Further researches made by scientists of all countries have substantially confirmed these assertions.

Manganese acts in a variety of ways: directly or catalytically as fertiliser, stimulant, antiseptic and anticryptogamic; it accelerates germination and maturation, increases the yield and improves the crop.

Experiments made everywhere, in Europe and Japan, have given results varying in importance but rarely negative. Difference of opinion arises not as to the actual principle of the function of manganese, which is incontestable, but as to the form in which it should be used. Many consider that oxides are ineffective; sulphate and chloride have given doubtful results, but carbonate and especially lime with manganese have been almost unanimously approved. The author next reviews all the researches which have been made in this matter up to the present, and hopes that further investigation will soon solve the remaining problems.

BERTRAND has proved that the action of manganese is catalytic and influences the composition of various bodies without itself being modified, a suitable application of manganese stimulates the microfloral activity of the soil and ensures the better utilisation of the existing food material.

BOULLANGER has proved the great difference in the catalytic power of manganese according as the soil is rich in nitrogen, phosphoric acid and potash. In poor soil, chloride of manganese gave only a slightly increased yield of potatoes, but in rich soil, it showed an increase of 32 %. CANDA, in Italy, also maintains that manganese has an indirect catalytic effect and dissolves the previously existing fertilisers. In poor soil, its action may even be injurious. KELLEY, on the contrary, maintains that the stimulating action of manganese is positive in poor clay-silicic soils, slight in rich soils and negative in acid soils.

STEYN and BURGERS in Holland, observed that after the use of manganese, maize showed much greater development, the leaves became much larger and there was an increase in yield of 100 ox. Also in Japan, SOLOMON in Italy and DUMONT in France were also in favour of its use.

Investigations on the beneficial effect of manganese on plant life and especially on the acceleration of germination were made by the following: GAROLA, CROCHETELLE, NOTTIN, BARTMANN, LOEW, BOULLANGER, VOELKER, BAUER and MOLINARI.

Experiments by RAY, PRADIER and BARTMANN prove that manganese accelerates maturation.

The increase in yield through manganese has been proved by numerous experiments. THOMASSIN obtained an increase of 20 to 35 % in oats and 15 % in beets; BOULLANGER an increase of 12 % in oats with lime and manganese only, and of 40 to 48 % by the addition of other fertilisers; ASO in Japan obtained an increase of 30 % in the rice yield; and BARTMANN's experiments on maize, cabbages and potatoes were equally conclusive, as well as those by GARDA on flax, LEBLANC on asparagus and BLANCHARD on onions.

Manganese not only increases the yield, but in many cases considerably improves the quality; this is especially the case with beets. GAROLA observed that manganese sulphate not only increases the weight of beets,

but their sugar content also, by 50 %; manganese chloride, which increases the weight still more, on the contrary increases the sugar content only by 25 %. GRÉGOIRE attributes to manganese an increase in sugar content and a corresponding decrease in weight, so that there is neither gain nor loss. DELORME and BOULLANGER observed that barley for malting did not increase in weight but improved in quality, the grain becoming larger, whiter and better nourished. J. M. SAULNIER obtained very favourable results by using manganese salts (1).

As regards its antiseptic and anticryptogamic qualities VON BAUER observed that manganese causes chlorosis spots on diseased plants to disappear. CLAUSEN HAIDE successfully used manganese against oat jaundice. DEMOLON, SIROT and JORET proved that slags used in agriculture contain from 4 to 5 % of manganese to which they attribute some of the useful effects of basic slag which were previously thought to be due to phosphoric acid and lime.

To sum up, from all scientific research, and in addition from the results already obtained on farms, the importance of manganese becomes evident. It remains to be seen:

- 1) In what form manganese salts should be used.
- 2) On what soils and crops they give the best effects.
- 3) Whether they should be used alone, or mixed with other fertilisers.

The author concludes by insisting on the urgent necessity of further and numerous experiments to determine the exact value of this new fertiliser.

A. D. B.

939 - **Inoculation of Leguminous Crops.** -- ARNY, A. C., and MC GINNIS, F. W., in *Journal of the American Society of Agronomy*, Vol. 13, No. 8, tables 6, bibliography of 14 publications. Washington, Nov. 1921.

The use of commercial cultures for inoculating the seed of leguminous crops has not proved altogether satisfactory.

The application of soil from a field used for a leguminous crop to another field involves labour difficulties, especially if the second field is far away. As a general rule 100 to 300 lb. of soil per acre or more is required.

The authors have tested a new method, namely that of applying inoculated soil to the seed of leguminous crops. Seeds of soy bean, alfalfa and sweet clover were used with water, and concentrations of glue and sugar,

(1) Reference is made to the important experiments made by SAULNIER in 1898-1900 in the trial plots at Suessola, organised on the model of the Experimental Station at Rothamsted by the late Prof. I. GIGLIOLI. Of 8 series of plots in which wheat was cultivated and to which a dressing of manganese dioxide, mixed in each case with other and different fertilisers, was applied, 4 gave good results, namely those treated with nitrate of soda, manure, superphosphate and sulphate of ammonia, superphosphate with sulphate of ammonia and sulphate of soda. Manganese dioxide proved more favourable for grain than straw. -- See ITALO GIGLIOLI, " *Cultura del frumento, Esperienze con biossido di manganese. Campo sperimentale di Suessola, 13° anno di coltura continua del frumento e granturco* ", pp. 133-147. Portici, 1901. (Ed.)



and the soil made to adhere to the moist seed, afterwards dried and sifted and prepared for inoculation purposes. Tests were made both in the greenhouse and in the field. The trials made with sand and sterilised sand were not satisfactory and were discontinued.

The same weight of soil was added to certain seeds at the time of sowing and the results compared with untreated seed, and with the seed with the commercial culture

The first mentioned method gave good results and with one or two exceptions, a large number of nodules were produced, and the plant was well developed. Still more satisfactory results were as a rule obtained with the commercial culture.

A comparison was also made as to the efficiency of water, glue and sugar solution at 5 % and 30 %. But these did not give satisfactory results, and the glue and sugar solution method of obtaining soil adherence is not therefore recommended. After inoculation with soil or with commercial cultures, the seeds may be stored in a suitable place for one month or more without any injurious effect.

Exposure of the soil to sunlight for 3 hours, and of the commercial culture for a half-hour in October, did not alter the efficiency of these means of inoculation with soybean seeds, but for alfalfa there appears to be some reduction in efficiency. Exposure of the seed to more intense heat of spring and summer sun might prove harmful and should be avoided whenever possible.

L. V.

940 — **Root Development in Barley and Wheat.** — BRENCHELY, W. D., and JACKSON, V. G. (Rothamsted Experiment Station) in *Annals of Botany*, Vol. 35, No. 140, pp. 533-556, figs. 4 London, Oct. 1921.

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Study made of root development and the correlation between root and shoot development. Pot cultures were made with heavy soil from the Experimental Farm with the addition of 10 % sand. These served for control purposes; to others were added the following fertilisers: sodium nitrate, superphosphate, sodium nitrate + superphosphate, potassium sulphate + superphosphate. Measurements were taken after drying and the rate of growth is shown in diagram form.

A strong root system for barley was shown, especially with sodium nitrate and even more marked with sodium nitrate + superphosphate.

The differences in growth between the various cereals, except when nitrate of soda + superphosphate was used, decreased or disappeared after 5 to 6 months. Relatively speaking, there was also a more marked development of shoot growth, but no parallelism can be drawn; it may be considered, however, that the shoot-root ratio attains the maximum with superphosphate + potassium sulphate and the minimum with superphosphate + sodium sulphate.

With wheat, the actual effect of the fertilisers on root development was not apparent; at certain stages, the root development seemed to be inferior to that of the control, especially when sodium nitrate was used. There is however, a more evident development of shoot system. The most

marked effect as regards roots was with superphosphate + potassium sulphate, and by superphosphate + sodium nitrate.

The types of root system both for wheat and for barley are more or less similar. A certain number of primary roots were developed vertically, lateral formation was then noted at the bottom of the pot; the actual appearance and habits of these lateral roots, described in detail by the authors, varied inherently with the fertiliser employed.

In the open field, the barley roots are thinner and more abundant than in the pots and are found near the surface. Oats behaved in the same manner; the wheat penetrated deeper.

In every case, both in pots, in the field, and more especially in water cultures, the *white roots*, distinguished by their thickness, and waxy appearance were prominent. Laterals are rarely seen; some of the longest roots bear a few short laterals near the crown, formed after the others and found in greater abundance early in the spring, especially in the case of barley. After a time, laterals are produced and gradually lose their characteristic appearance; finally it is impossible to distinguish them from ordinary roots. The "white root" formation was increased with barley after the application of superphosphates + potash; the wheat appeared to be unaffected. These changes are difficult to explain and offer a promising field for research. A comparative study of the anatomical structure of the ordinary and white roots has been started by one of the authors.

It is noticeable also that the slender roots produced laterals whilst still very small, especially towards the tips. These remained for some time and finally adopted the characteristics associated with the ordinary roots.

L. V.

941 - **Influence of Wheat Growth on the Hydrogen-ion Concentration of Plant Food Solutions.** — JONES, L. H. and SHIVE, J. W. (New Jersey Agricultural Experiment Station, Department of Plant Physiology) in *The Botanical Gazette*, Vol. 73, No. 5, pp. 391-400, bibl. of 18 works. Chicago, Ill., May 1922.

Certain solutions used in experiments on plant physiology show rapid and remarkable modifications in their hydrogen-ion concentration when used for plant growth; others, on the contrary, show few changes because they contain salts capable of fixing the hydroxyl-ions.

In connexion with this question, the writers have studied 20 formulae advanced by several investigators. They placed young wheat plants in the solutions and made the determinations by the Gillespie method in the course of 52 hours. Results showed that in certain solutions the hydrogen-ion concentration presented very slight modifications; for instance, the CRONE and SACHS solutions remained at 6.6, 6.7 pH; hydrogen-ion concentration is generally reduced; it passes from 4.2-4.8 pH to 5.3-6.1 pH in 6 solutions; the reduction was greater in more concentrated solutions; in 6 LIVINGSTON-TOTTINGHAM types containing 3 salts it was also reduced, passing from 3.6-4.6 pH to 5.4-5.8 pH; in 2 modified TOTTINGHAM solutions, on the contrary (replacing potassium nitrate by ammonia sulphate), the concentration rose slightly, from 4.8 to 4.2 pH. These last solutions, therefore, are quite suitable in the case

of crops for which it is not desired that the hydrogen-ion concentration should vary appreciably under the influence of plant growth. They also have the advantage of being able to take up iron in a form which can be assimilated by growing plants.

L. V.

- 912 - **Effects of Borax upon Plant Growth.** — NELLER, J. R. (Formerly of the New Jersey Agricultural Experiment Station) and MORSE, W. J. (Maine Agricultural Experiment Station) in *Soil Science*, Vol. 12, No. 2, pp. 79-105, 13 plates, bibl. of 17 works. Baltimore, Aug. 1921.

The experiments reported in this paper are based on numerous observations made by farmers and scientists regarding the harmful effects of boron compounds (boric acid, potassium borate, sodium borate, borax, etc.) added to manure as larvicides or contained in certain chemical fertilisers.

The writers more especially proposed to ascertain if the above-mentioned action is due solely to boron, and what is the maximum quantity which can be applied without injury. They made numerous pot experiments, using a compound fertiliser made from sodium nitrate, acid phosphate and potassium sulphate, to which was added commercial borax containing 67.2 % of anhydrous borax; the experiments were made on maize, beans and potatoes.

The beans were tolerant to a maximum quantity corresponding to 3 pounds of anhydrous borax per acre, maize as much as nearly 5 pounds and potatoes a little more. If, instead of being applied in the drills, the boracic fertiliser was well mixed into the soil, the plants were not quite so easily affected. A commercial fertiliser containing borax was found to be considerably more toxic than an equal quantity of boracic fertiliser used by the writers. The toxic effects were variable; the writers describe them with full details.

During the experiments the soil was kept at an average optimum water content of 19.2 % with but little modification. By reducing the soil moisture, the toxic action of the borax was increased, and vice-versa.

Certain previous observations led to the conclusion that salts of lime diminish the toxicity of various organic substances. The writers confirmed the fact that limestone effectively limits the toxicity of borax as regards the first three plants experimented upon; gypsum and manure only protected maize, no effect being observed on the other two plants.

Some writers have reported that small quantities of boron act as a stimulant, but the authors only observed a doubtful action, and that with maize alone.

L. V.

- 943 - **Effect of Röntgen Rays upon the Growth of *Oryza Sativa*.** — KOMURO, H., in *The Botanical Magazine*, Vol. 36, No. 421, pp. 15-17. Tokyo, Jan. 1922.

Investigations by YAMADA (1917), carried out on an aquatic variety of *Oryza sativa*, proved that a weak irradiation (3 H and 5 H) of the seeds gives an increase of amount of crop. Investigations by NAKAMURA (1918) on another aquatic variety gave similar results.

The author did not confirm these results. He used a third aquatic

variety and employed rays of 4.5 — 6° intensity; the exposures were 5 to 15 H for steeped and air-dried seeds, and 3-7 H for steeped seeds; and the experiments were carried on both in pots and in the field, but not on a large scale. The author thinks that his predecessors were to some extent mistaken in their observations.

I. V.

- 944 — **Sulphur Content of Alfalfa.** — HALL, E. H. (Hull Botanical Laboratory) in *The Botanical Gazette*, Vol. 73, No. 5, pp. 401-411, bibl. of 15 works. Chicago, Ill., May 1922.

The author confirms the fact that the sulphur content of alfalfa greatly varies; in hay grown in different parts of the U. S. he found 3.3 to 5 kg. per ton; so that if the alfalfa yield is 12 to 20 tons per ha., it removes 40 to 100 kg. of sulphur per ha. from the soil, an amount which is in excess of the atmospheric sulphur returned by rain. From WOLFF's old ash analyses, it was assumed that plants contained but little sulphur, and that it was not necessary therefore to furnish fresh supplies. But we know now that plants consume a great deal and that it is one of their principal elements, like nitrogen, potash and phosphorus; the same may be said of calcium and, in certain cases, of magnesium.

The greater part of the sulphur was in the organic form; that in the inorganic form was never more than 10 % of the total, while in certain samples of alfalfa there was none at all. The average was 4.35 %. These results differ from PETERSON's determinations, who found the ratio to be 1 : 1.

The author also made nitrogen estimations but does not give the results.

This investigation was carried out under a research fellowship from the Gypsum Industries Association.

I. V.

**PLANT  
BREEDING**

- 945 — **S. B. Y. and Blo. 38, Two new Varieties of Sweet Potato obtained by Selection in the Philippines.** — MENDIOLA, N. B., in *The Philippine Agriculturist*, Vol. X, No. 5, pp. 177-189, 1 pl. Los Baños, Laguna, Dec. 1921.

This work gives the results of a series of investigations and researches carried out at the Agricultural Experiment Station in the Philippines with a view to improving the sweet potato by selection.

The initial experiments were carried out, and results obtained, from the following varieties: Samar Big Yellow, which, in December 1919, gave the highest yield, Binandera, Binglo, Boled Zooling and others unidentified but distinguished by the letters B. C., and D.

The offspring of these varieties show great variability in leaf shape, yield in tuber, colour of skin and flesh and flavour of the tuber.

The following table shows the comparative weight of yield of some offspring of Binandera.

*Weight of tubers per Plant produced by Seedling offspring of Binandera.*

Offspring No	Wt. of tubers produced gm.	Offspring No	Wt. of tubers produced gm.
1	127	6	95
2	380	7	340
3	1 090	8	2.333
4	75	9	430
5	107	10	70

This variability may be taken as an indication that some of the varieties of sweet potato which have been propagated asexually are heterozygous with respect to a number of characters.

The author made a careful selection of a large number of seedlings.

It is well to note in this connection that a one-year test is not sufficient to decide which are superior. The final selection should therefore be made with care and only after a sufficiently long period has elapsed.

Selection has already led to the isolation of two good types S. B. Y. and Blo. 38 the first from Samar Big Yellow and the second from Bingle.

Their description is as follows:

S. B. Y. 98. — Stem, 5 metres long and 3 to 6 mm. in diameter; colour pale green with slight tinge of purple which becomes more distinct with age; hairs not abundant. Leaves cordate, mature leaf 7 to 9 cm. long and 6 to 7 cm. wide; first purple with slight tinge of green, then green with purplish veins, petiole 7-11 cm. long. Growth vigorous, matures early, tubers roundish or somewhat elongated, medium to very big and almost free from disease; skin, reddish purple; flesh, outer portion yellowish, with ring of purple next tinged with slight yellow, central portion more yellowish. Cooked tubers have a faint pleasant odour, turn to a light purple and yellow colour and are rather sweet; good pastry may be made from them. This variety is an excellent yielder.

Blo 38. — Stem, 3.5 m. long and 4-6 mm. in diameter, green, hairs abundant, leaves, cordate, 8-10 cm. long and 7-9 cm. across first purple with green tinge, then green, petiole, 6-14 cm. long. Growth not very vigorous; matures early; tubers, roundish or somewhat elongated; medium to very big; not entirely free from disease; skin, light purple; flesh, cream-coloured with circular ring tinged with purple. Cooked tubers sweet and have pleasant odour, the skin becomes dull purple and the flesh creamy yellow. A good yielder.

These new varieties will be tried on outlying farms

G. A.

946 — **Investigation on Hard Seed Germination.** — GIRON, E. G., in *Boletín de Agricultura Técnica y Económica* (Estación Central de Ensayo de Semillas de la Moncloa), Años (years) XIII and XIV, Nos. 151-154-159, pp. 230-240, 596-608, 821-828. Madrid, 1921 and 1922.

The author first briefly reviews the different methods of treating hard seeds which have been followed up to the present; he divides them

SEEDS

into 3 groups : mechanical, physical and chemical, and says a few words on their advantages and disadvantages. He afterwards quotes the experiments made by Professors LOVE and LEIGHTY on red clover seed by treating it with sulphuric acid, and finally describes the experiments made at the " Estación central de Ensayo de semillas de la Mencia " on " algarrobo " seed (*Ceratonia siliqua*). A description of these experiments and their results are given below.

The seed used was taken from one among a number of lots at the corn market ; they were not a wide and most representative (closely conforming) selection, as is generally the case. The treatment consisted in steeping lots of 100 seeds each in sulphuric acid for varying periods. They were afterwards carefully washed until all trace of the acid had disappeared.

They were germinated both on sand and in filter paper bags, care being taken in the first case to bury the seed at a depth of 4 to 5 mm. only. The root thus appeared near the surface, and the plant could be observed taking root without its being necessary to turn up the sand and risk injuring the young organs.

In Tables I and II the details and results of these first trials are shown. Two other tests were then made with " ungerminated, healthy " seed, details of these latter tests are given in Tables III and IV.

From these experiments the author draws the following conclusions.

- 1) The germination of " algarrobo " seeds is encouraged by their being subjected for a certain time to the action of sulphuric acid.
- 2) The various groups of seed tested showed the best results after being treated for a period of 30 minutes.
- 3) Intermittent treatment is still more beneficial, a sufficient number of days being allowed to elapse between the partial treatments.
- 4) The plants obtained grow normally.

The author concludes his investigation with some notes on the relation between the attack of mildew, observed during the experiments on seeds of which the tegument was injured, and on the duration of the sulphuric acid treatment. He concludes that the percentage of seeds attacked by mildew is smaller in proportion as the duration of the treatment approaches the beneficial maximum.

TABLE I — " Algarrobo " seed test. Germination in sand beds for 26 days.

No of seeds in group	Duration of sulphuric acid treatment	germinated	No of seeds	
			ungerminated	
			healthy	spoilt
100	0'	8	76	16
100	20'	72	20	8
100	30'	86	3	11
100	60'	32	0	68

TABLE II. — "Algarrobo" seed test.  
Germination in filter paper bags for 23 days.

No. of seeds in group	Duration of sulphuric acid treatment	No. of seeds		
		germinated	ungerminated	
			healthy	spoilt
100	0'	16	52	32
100	15'	40	36	24
100	30'	88	0	12
100	60'	36	0	64

TABLE III. — Results of 2nd treatment of seeds not germinated in table I test,  
23 days germination.

Duration of 1st. treatment	Duration of 2nd treatment	No. of seeds treated	Results in the group		
			germinated	ungerminated	
				healthy	spoilt
0'	15'	76	60	0	16
20'	30'	20	20	0	0

TABLE IV. — Results of 2nd treatment of seeds not germinated in table II test,  
11 days germination.

Duration of 1st. treatment	Duration of 2nd treatment	No. of seeds treated	Results in the group		
			germinated	ungerminated	
				healthy	spoilt
0'	15'	52	40	8	4
15'	12'	36	36	0	0

J. P. C.

947 - The Effect of Nitrates applied at different Stages of Growth on the Yield, Composition and Quality of Wheat. — DAVIDSON, J. (Plant Chemical Laboratory, Bureau of Chemistry, U. S. Department of Agriculture, Washington, D. C.) in the *Journal of the American Society of Agronomy*, Vol. 14, No. 4, pp. 118-122. Bibliography of 2 works. Geneva, N. Y., April 15, 1922.

CEREALS  
AND  
PULSE CROPS

An experiment made by the author in collaboration with LA CLERC showed that the application of sodium nitrate during the early period of growth increased the yield of wheat; when applied at the time of heading the quality of the grain was improved, but the use of nitrate at the beginning of the milk stage had no effect either on yield or the

quality of the crop. The experiment was carried out in the year 1919 at College Park, Maryland. The period between the resumption of the growth of wheat in the spring and the time of heading was divided into three sub-periods. Each of three corresponding sets of plots received nitrate of soda or nitrate of calcium at one of these sub-periods; the experiments were repeated to make sure of the effect of the nitrates; the number of plots was thirty-six.

The effect of nitrate in increasing the yield decreases consistently as the time of their application approaches the stage of heading.

The effect of nitrates in increasing the protein content ( $N \times 5.7$ ) of the grain increases as the effect on yield decreases. The deeper colour of the grain showed qualitative modification. L. V.

948 - **The Milling Quality of Saskatchewan Wheat.** — CHAMPLIN, M and GOULDEN, G H, in *Scientific Agriculture*, Vol II, No 8, pp 283-305. Gaidenvale, P Q, April 1922

The actual value of wheat grain cannot be estimated by the plant characters of the variety, and only to a slight extent from the appearance of the sample after threshing. The actual value or quality can only be ascertained by means of a milling and baking test.

For the past eight years the University Field Husbandry Department has been carrying on field tests with the leading varieties of wheat and each year samples of these wheats have been sent to some reliable wheat testing laboratory in order to have their milling and baking qualities determined. The data obtained from these tests are now available and serve to indicate the relative values of wheats and some of their qualities. A description of the methods of analysis is also given. The different varieties of wheat are arranged in groups, each group having in common some particular qualities which distinguish it from the rest.

Group I: Marquis, Red Fife, Kitchener, Red Bobs.

Marquis and Red Fife both possess excellent milling qualities. These results are in accord with those reported by other investigators (1). The remaining members of this group are high quality wheats, especially Kitchener which was considered to be one of the best milling wheats.

Group II White Bobs, White Fife, Taylor's Wonder

All these are white wheats. Taylor's Wonder is a soft wheat, lacking in baking strength, but has given fairly good results. White Fife is at least equal to Red Fife.

Group III Prelude, Pioneer, Preston, Chelsea.

Fairly good milling value, but with no outstanding results.

(1) *Marquis Wheat* — BALL, C R and CLARK, J A, U S. Department of Agriculture D C. *Farmers' Bulletin*, No 732 SANDERSON, T, Milling and Baking Results of Marquis v. Blue stem and Fife wheats — in *North Dakota Agricultural Experiment Station, Special Bulletin*, Vol 2, No 32 Food Department. ARNY, A C and BAILEY, C H, Marquis Wheat in *Minnesota Agricultural Experiment Station, Bulletin* No 137 *Report of the Dominion Grain Research Laboratory*, Winnipeg, Man., 1920. Submitted by RICHARD, F. J. (Ed)



Group IV : Ruby ; no great milling value, but promises well as an early wheat in the northern districts

Group V : Club, Redstone, Alaska, Kinley, Stanley : — Medium value for milling. Although the Alaska variety has large ears, results after analysis have proved unsatisfactory (1).

Group VI : Kubanka, Acme, Pélissier, Monad and Amber Durum varieties : — Suited to warm localities with a dry ripening period. Acme and Monad give high yields, and are resistant to drought and rust ; the poor quality straw however renders them unsuitable for heavy soils. Kubanka is acknowledged to be the best milling variety of durum wheat and is used chiefly in the manufacture of macaroni, spaghetti and for blending purposes.

Group VII : Red Durum (D5)

This grain is hard, bright and vitreous, it is immune from stem rust (*Puccinia Graminis*), but the flour is weak and not satisfactory either for baking or for macaroni

The author supplements his report with a table giving the principal varieties of wheat harvested in 1920, their protein content, absorption capacity, loaf volume, colour, texture and the general appearance of the bread made from them.

A number of experiments were made during the years 1915 and 1916 in order to ascertain the influence of the time of harvesting on the value of Marquis Wheat as regards milling and baking, and the following deductions were made :—

- 1) Loaf volume increases directly with the maturity of the grain.
- 2) Flour colour improves with maturity, flours from early cuttings were all slightly greyish
- 3) Gluten content increases directly with maturity.
- 4) Weight of loaf and water absorption decrease slightly as the grain ripens.

In conclusion it may be stated that it is very important to allow the wheat to reach at least the dough stage before cutting. The wheat is much improved by allowing it to harden fully, but the difference is not sufficient to warrant the farmer taking any risks in getting his crop harvested. Immaturity is undoubtedly detrimental to the value of the wheat grain.

*Importance of the Milling and Baking Test in Wheat Breeding* — A milling and baking test must be made upon the grain as soon as the selection has reached a stage where a sufficient quantity is available for the purpose. This will give an accurate indication of any improvement in quality and will allow the breeder to eliminate poor quality strains at the outset. Thus labour and expense will be saved and the distribution of a poor quality wheat prevented.

F. S.

(1) BALL, CARLSTON, R., and LEIGHTY, C. E., Alaska and Stoner or "Miracle" wheats, two varieties, much misrepresented U. S., Department of Agriculture Bulletin No 367, 1916.

949 - **Influence of Wheat Development on the Hydrogen-ion Concentration of nutritive Solutions.** — See No 941 of this Review

950 - **On Root Development of Barley and Wheat.** — See No 940 of this Review.

951 - **Smooth-Awned Barleys.** — HAYES, H K, and WILCOX, A N (Minnesota Agricultural Experiment Station, Division of Agronomy and Farm Management), in *Journal of the American Society of Agronomy*, Vol 14, No 4, pp 113-117, bibliography of 9 works. Geneva, N J, April 15, 1922

Farmers find the presence of awns in wheat and barley uncomfortable in handling and for this reason breeders have devoted much of their attention to the production of awnless varieties. It has however to be noted that the awns have definite physiological functions, which have been brought out by several investigators. If the awns are removed a quite noticeable reduction takes place in transpiration which is particularly active at the time of carbohydrate formation in the seed, which it appears to stimulate. A reduction of about 10 % also occurs in the volume and weight of the seed according to PERLITUS while the spikes become brittle owing to the deposition of dry matter which in the case of normal spikes takes place largely in the awns according to HARCAN and ANTONY

It is still more important that awnless varieties give a smaller yield than awned as has been discovered by GRANTHAM for wheat and proved by experiments carried out at the Minnesota Station with awned and awnless hybrids resulting from the same crossings

Attempts have been made to obtain the physiological advantages of the awns and at the same time to eliminate the discomforts they cause in handling, by cultivating varieties of wheat and barley with smooth or flexible awns, which at present have merely a botanic value. HARLAN is responsible for this solution which has been studied for several years at the Minnesota Station where varieties of barley with smooth awns have in certain years produced a fair yield, in other years the yield has been considerably reduced as these varieties show themselves highly susceptible to *Helminthosporium sativum*.

New crosses and more resistant strains have now been tested. In 1920 and 1921 an average yield was obtained superior to that of Manchurian barley which is awned. These varieties have also given good transpiration results, one gramme of water per hour for 10 heads of smooth awned barley and also for Manchurian, while certain barleys both awned and awnless gave much less. The new varieties therefore seem to be very promising

L. V.

952 - **North African Barley and Malting.** BOEUR in *Revue Agricole de l'Afrique du Nord*, 20th year, No 155, pp 458-463. Algiers, July 21, 1922

The author classifies the barleys used in brewing, mentions the qualities most sought after in them, and describes the characteristics of North-African barleys

A table accompanies the description, showing the percentage of moisture, dry matter and nitrogenous matter contained in two-rowed barley and

winter barley from various districts collected in 1910 and 1911. The author replies as to certain faults found with North-African barleys, and after having indicated certain improvements to be made in their cultivation, he draws the following conclusions: the winter barleys cultivated in North Africa are adapted to malting and are largely used in high fermentation brewing; they may form 15 to 20 % of the total used in low-fermentation brewing.

The better kinds should be selected, cleaned and distributed in suitable quantities.

Two-rowed barleys do not degenerate in North Africa. The kinds which combine industrial qualities with a good yield and sufficient resistance to rust and smut, should be placed at the disposal of farmers in order that their cultivation may be extended. F. S.

953 - **Date of Sowing for Maize.** - BROWN, E. I. and GARRISON, H. S. (Office of Cereal Investigations), U. S. Dept. of Agriculture, *Bulletin No 1014*, pp 1-14. Washington, Jan. 11, 1922.

Report of investigations in progress from 1915-21 at the Arlington Experimental Farm, Rosslyn, Va. near Washington D. C. It appears that although the total growth of stalk was greatest for spring sown maize (May and June), the rate of growth was slower than with June and July sowings, and the earing was also deferred. The pollen period was longer, but the number of ears, the size of the ear and the sucker growth did not appear to be affected.

With very early sowings (April), not only was the rate of growth slower, but the stalks were usually shorter. In 1917, for example, the April sowings produced plants with stalks only 75.6 inches in height; May sowings 86.4 in. stalks; June sowings 88.8 in.; July sowings, 76.8 in. Earing and ripening were somewhat hastened. L. V.

954 - **Fenugreek in Algeria.** — DUCELLIER, I (Professor at the Agricultural Institute of Algiers) in *Revue Agricole de l'Afrique du Nord*, Year 20, No 133, pp 106-109. Algiers, February 17, 1922.

FORAGE CROPS

Trigonal fenugreek (called "helbe" or "helba" in Algeria) has become much less important as a forage crop, especially in the Mediterranean district, but is still valued in the East, in India and in the Valley of the Nile, both as a forage plant and for its seeds; in Tunisia and Morocco it is cultivated chiefly for its seed production. Morocco exports an average of 70 000 quintals of fenugreek seed per year, and most of it comes from the Casablanca district. In Algeria this legume is at present very little cultivated.

There are several varieties of fenugreek: only one with angular seeds, is cultivated in Tunisia, Algeria and Morocco. Another variety from Khartoum with smaller and rounded seeds, tried at Maison-Carrée, did not give such good results.

In Algeria the forage-yield of fenugreek generally varies from 25 to 30 tons per ha., which corresponds to 4-6 tons of dry hay. In fertile soil the yield of green forage may be as much as 50 to 60 tons.

Fenugreek produces 10 to 12 qx. of seed per ha. ; the latter in North Africa often includes seeds from other casual plants, such as *Bupleurum protractum*, rye grass (*Lolium multiflorum*), brome grass, barley, oats, etc. The presence of wild ray-grass seed or corn-seed among that of fenugreek is rather advantageous than otherwise from the point of view of forage-production; rye grass, growing among fenugreek improves the quality of the forage given by the latter and helps it to dry.

The weight of a hectolitre of fenugreek seed including admixtures varies from 70 to 75 kg. in Algeria; when dressed the seed may weigh as much as 78 kg. F. D.

OIL BEARING  
AND NARCOTIC  
PLANTS

955 - **Sunflower Growing in Rhodesia.** — MAINWARING, C., The Common Sunflower, in *Bulletin No 423, Department of Agriculture, Salisbury, Rhodesia*, pp 8. June 1922.

The Sunflower is very often employed as an accessory crop in the mixed farms of Rhodesia. The seeds are chiefly used in poultry-feeding and to some extent mixed with other fodder as a cattle-food: a certain amount of oil extraction also takes place.

In Rhodesia the sunflower is highly drought-resistant and in 1921 the area under cultivation was 3974 acres with a yield of 23 204 bags of 103 lb. apiece. The acreage for 1921 was nearly double that of the preceding year but the yield per acre was somewhat lower, viz 15.8 sacks as against 6.7. An analysis of the air-dried leaves of Rhodesian Sunflowers gave the following figures: Water: 14.87 (78.73 % for fresh gathered leaves) — Ether Extract: 2.82 — Protein: 16.50 — Carbohydrates 42.15 — Crude Fibre: 7.87 — Ash: 15.79 %. The corresponding figures for United States Sunflower leaves were respectively: 12.51 — 4.09 — 10.15 — 38.83 — 13.16 — 21.26 %. Thus the Rhodesian Sunflowers were over 62 % richer in protein and 47 % lower in crude fibre and 31 % lower in fat than the American.

After the removal of the seeds the Rhodesian sunflower heads gave on analysis: Water: 11.73 — Ether Extract: 3.18 — Protein: 8.86 — Carbohydrates: 46.42 — Crude Fibre: 18.19 — Ash: 11.6 %. For United States sunflower heads the corresponding figures were respectively: 7.40 — 5.07 — 9.91 — 39.79 — 18.44 — 19.39 %.

Of the three principal cultivated varieties, the large white seeded, the small black seeded and the striped seeded, the second is the most largely grown in Rhodesia.

The sunflower takes four to five months to mature and is comparatively free from diseases and insect pests. An average crop gives a yield of about 12 to 14 bags (of about 100 lb.) to the acre which can be doubled in exceptionally favourable conditions.

The oil is used for the table and also for general commercial purposes. It is claimed to be superior to most oils for soap-making. F. D.

956 - **Greek Tobaccos.** — HASSIOTIS, S. P. in *L'Economista d'Athènes*, 1st year, No. 23, pp. 355-356. Athens, Apr. 15, 1922.

In Greece before the war 23 to 24 million kg. of tobacco were produced. Home consumption only absorbed about 4 million kg. and the rest was

exported. During the war there was a great demand for Greek tobaccos, and this helped to extend their culture. But in 1918 the demand decreased and prices fell. This fall, and the reduced demand which caused it, discouraged cultivators. In 1921 production fell to 17 or 18 million kg.

Tobacco growing is one of the most lucrative branches of national production. The soil and climate of Greece are very favourable to the production of all kinds of tobacco, from the exceptionally fine quality Xanthian and Eastern Macedonian to the inferior but treble-yielding quality of the Nauplia-Agrinio district.

The average yield is 80 kg. per stremma (800 kg. per ha.).

After garden crops, this crop is the most profitable to the grower, whose wife and children may be employed in the work of cultivation.

If the manufacture of cigarettes for export were developed on a large scale in Greece, a great and profitable industry could be carried on under very favourable conditions.

I. S.

957 - **Cultivation of the Opium Poppy in Bulgaria and Macedonia.** — NIKOLOFF, M., in *Списание на земеделските изпитателни институти в Българска за природонаучни и стопански изследвания из областта на земеделието.* (*Review of the Institutes of Agronomical Research in Bulgaria etc.*), year II, No 3-4, pp. 217-241 (abstract in German, p. 242) Sofia, 1922.

The opium poppy (*Papaver somniferum*) succeeds very well in all parts of Bulgaria and its culture and preparation is of growing importance. In 1919 the poppy covered 9 340 ha., and produced 379 193 kg. of seed and 2 034 kg. of opium. Of these, 7 840 ha. producing 329 083 kg. of seed and 971 kg. of opium belong to old Bulgaria and the rest to the Petritsch and Melnik districts in Macedonia.

Investigations made by the author showed that the Bulgarian poppy products (seed, oil, opium) are of excellent quality. The seeds are very rich in oil up to 49 % and the opium in morphine as of 119 samples of opium analysed, 27.8 % contained 10 to 15 % of morphine; 41 %, 15 to 17 %; 21.3 %, 17 to 19 %; and 6.8 % 19 to 21 %. The poppy in which an early incision is made generally contains a higher percentage of the narcotic. In opium kept a long time, the morphine content diminishes, even when every care is taken (1).

The manufacture of poppy oil is defective in Bulgaria; the oil-cake contains 8 to 19 % of oil (2).

I. D.

(1) See R. Apr. 1922, No. 428.

(2) The defects in the seed-oil industry are general in Bulgaria. There is a lack of appliances in the numerous small oil-mills erected during the war. A series of analyses of various seed-cakes and especially of sunflower seed cake, made at the Agricultural Experiment Institute at Sofia, gave 8 to 20 % of fats and 20 to 40 % of proteids (KULUMOFF, CHR. J., *Sur la composition chimique de nos tourteaux oléifères, Revue des Instituts de Recherches agronomiques en Bulgarie*, Year II, No. 3-4, p. 255). Sofia, 1922. (Ed.)

ARBORICUL-  
TURE

958 - **A new Test for the Maturity of Fruit.** — MURNECK, A. F. (Oregon Agricultural College, Experiment Station, Department of Agriculture) in *Station Bulletin*, No 186, 28 pp., 9 figs. Corvallis, Oregon, Nov 1921.

Experience shews that pears, unlike other fruits, must be harvested in a comparatively unripe condition, thus Bartlett's, when picked hard and green, ripen perfectly and attain the highest quality.

In most districts the harvesting season of this variety lasts about a month, whereas it may take 6 to 8 weeks from the date of the first picking to the time the fruit becomes fully ripe on the tree. It would be useful to know exactly the right moment for picking in order that the highest keeping and eating quality may be realized. For this purpose it would be necessary to know exactly the changes that take place as maturity advances.

Many tests have been used to ascertain the stage of maturity of pears and the best time for picking: the colour of the skin, the colour and toughness of seeds, the sweetness, the ease with which the fruit stem will separate from the spur, the ease with which the finger may be pressed into the fruit, the disappearance of starch, as tested by potassium iodide, etc. Ordinarily for Bartlett's the largest transverse diameter (about 2 1/4 inches on an average) is taken as an index. All these tests, are however, uncertain. The Oregon Agricultural Experiment Station has therefore endeavoured to find a simple but reliable test. This problem has been made a part of the pear harvesting and storage investigations, which were begun in 1917 and have already formed the subject of two reports.

It has been recognised that the amount of pressure required to wound the fruit, that is, its resistance to pressure, gives a good, practical and delicate test.

To measure this pressure exactly, an apparatus was constructed after several attempts, a kind of pressure register, which solves the problem pretty well. The pressure required for a small metal cylinder to penetrate to a determined distance is registered in pounds on a scale.

To eliminate individual variations, it is well to examine lots of from 10 to 15 pears. The test should be made 6 hours after picking, and Bartlett's, under good harvesting conditions, should register, on an average 35, and not less than 25 pounds. If they register more, they are very ripe and may be used with advantage for canning or preserving. The Bosc variety should register 26 to 20 pounds when picked.

The author has applied the test to other varieties of pears and to apples and several fruit growers in the States of Oregon and Washington have already adopted it. The author has also studied the increase in diameter and weight of Bartlett pears during development. The transverse diameter increases each week 5.1% on an average, and the weight 17.7%, until the maximum development has been attained. The ratio of percentage increase in weight to that in diameter is therefore about 1 : 3.5; but deviations and exceptions render this criterion uncertain and not very practical.

L. V.

959 - **Production of Table Olives in Italy.** — VIVARELLI, F., in *La Propaganda agricola*, Vol. XIV, No. 14, pp. 185-191. Bari, 31st July 1922.

The production of table olives in Italy varies, on an average, from 3000 to 3500 qx. per year. It does not give rise either to specialised culture or specialised industry with the exception, in a very slight degree, of some parts of the province of Ascoli-Piceno.

This production might be greatly developed, seeing that in Italy the olive covers 2 291 000 hectares of pure and mixed culture. On the Adriatic side of Central and Southern Italy it has become of growing importance in the last few years owing to the high prices paid for pickled olives. The Italian varieties most appreciated are: the Ascoli, Naples Beauty, Andrian or St. Augustine, Spanish Beauty or "plum" olive, "Rossanese", "Olivone", "Carmelitana", "Cucca", Black Olive of Ferrandina, etc.

The author more especially treats of the table-olive production of the Andria district (Province of Bari) which represents  $\frac{1}{8}$  of the total production of the country. The St. Augustine and Spanish Beauty varieties (described by the author) are mostly cultivated there. The fruit of the first-named although smaller are preferred, as their pulp is softer, and the stones are smaller. The mode of preparation is also described. F. D.

960 - **The Forests of Lettonia.** — *Viribus Unitis*, Year I, Nos. 6-7-8, p. 7. Warsaw, Oct., Nov., Dec., 1921.

FORESTRY

In Lettonia, 65 000 ha., i. e. 29 % of the country is covered by forests. These forests, comprising  $\frac{1}{5}$  deciduous and  $\frac{4}{5}$  conifers, are under State control. The annual yield (in timber) is 172 500 000 c. ft. (4 884 000 m<sup>3</sup>) of which 63.7 % is used for local needs, 22.3 % for roads and industry and 14 % is exported.

The forests are under the management of the Forests Department of the Ministry of Agriculture. At the High School there is a special forestry section for the training of forest-keepers. This Forestry Branch is conducted in an exemplary and scientific way and is entrusted to specialists.

During their occupation, the Germans cut down many forests which are not included in the statistics.

Saw-mills are now being erected. The wood-industry is showing renewed activity. In addition to wood, it is intended to export tar, door and window frames and wood for matches. By the terms of the peace treaty with Russia, Lettonia has the right to fell timber over an area of 100 000 desiatines (10,925 ha.) near the Lettish frontier. The rivers of Lettonia are suitable for rafting. The wood industry of Riga was very important before the war. A considerable quantity of wood is prepared for export. Steps have likewise been taken for the utilisation of wood by means of chemical processes (turpentine, tar refining, wood-spirit, cellulose, etc.). The paper industry already partially revived, is of special importance. Before the war, the Lettish mills showed a total production of 1 705 000 poods of paper (27 927 900 kg.) of which 1 000 000 poods (16 380 000 kg.)

were exported. By the exploitation of peat and the construction of the electric central power station, worked by means of water power, the home consumption of wood, will be diminished considerably, and its exportation increased.

961 - **Correlation between Type of Soil and Roots of Pine Saplings.** — See No. 921 of this Review.

## LIVE STOCK AND BREEDING.

### HYGIENE

962 - **The Duration of the contagious Period in Foot-and-Mouth Disease (1).** — LEBAIL, C., in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No. 24, pp. 1580-1582 Paris, June 1922..

The contagious period of foot-and-mouth disease is generally supposed to last for some weeks.

The Sanitary Authorities impose at least 15 days' quarantine after the recovery of the last case of this disease when it has broken out on a farm.

The author has found in his researches on cattle that any susceptible animal which is in contact with a diseased individual between the time of the initial rise of temperature and the rupture of the aphthae infallibly contracts the malady. If however the healthy animal is not introduced into the cattle shed until 4 days after the appearance of the first aphthic lesion which generally follows an attack of fever and salivation, the animal is not infected.

In the development of foot-and-mouth disease two periods should be distinguished; the first is the more dangerous, in that the only external symptom is a rise in temperature, but the second is the more distressing to the animals. When, however, salivation has taken place for 4 days they are no longer infectious, for the virus of foot-and-mouth diseases dies on the spot.

The malady is spread by infected animals only during the periods of its incubation and inception which last a very short time. This explains the inefficacy of sanitary measures applied after the epizootic has developed to a certain extent. Even the most radical measure such as slaughtering the stock is no more effective than careful supervision and the seizure of the first centres of infection. At times when foot-and-mouth disease is epizootic, no animal, however healthy it may appear, should be introduced into a sound herd until it has been in quarantine. F. D.

963 - **The Angermünde Disease of Foals.** — HOBMAIER, M (Oberassistent am pathologischen Institut der tierärztlichen Hochschule, Berlin), in *Berliner tierärztliche Wochenschrift*, Year XXXVIII, No. 16, pp. 181-184, figs. 3. Berlin, April 20, 1922.

In several parts of Prussia, the horse-breeders annually lose many of their foals from an epidemic diseases of which the cause is at present unknown. The author calls it the Angermünde disease after the village near which it is most prevalent.

(1) See April 1922, No. 444. (Ed.)



The absence of any microorganisms of bacterial, or protozoon character, was proved by a thorough macroscopic and microscopic examination of the organs of a foal killed after it had been suffering from the disease for about 2 months.

On the other hand, there was a large number of intestinal worms present, among which far the most numerous were the larvae of Sclerostomidae (*Nematoda*, *Strongylidae*). The whole mucous membrane of the intestine was covered with round, blackish cysts the largest being no bigger than a pin's head and each containing an embryo of *Sclerostomum* (*Cyathostomum*) *tetracanthum*. An anatomical pathological examination of the internal organs revealed the presence in the liver of the characteristic lesions of hepatic cirrhosis, while the lymphatic glands were seen to be greatly distended and the walls of the small arteries in the lining of the intestine had undergone considerable degeneration. This complex of morbid symptoms is due, in the opinion of the author, to the enormous number of Sclerostomidae mentioned above.

Although the author realises the necessity for carrying out further experiments on the subject, he believes that the following measures should at once be adopted for the control of the disease.

1) The excrement of all animals supposed to be infected should be examined to ascertain whether it contains any eggs (1). The results obtained are nearly always positive in the case of mares and negative in that of foals, as the latter never harbour sexually mature Sclerostomata.

2) All infected animals must be removed from the field and treated with ordinary antihelminthics.

3) The diseased individual should be treated by fumigation as this induces a lack of oxygen and the generation of excessive heat thus destroying the parasites which require for their development moisture and moderate heat. This method is called biothermic by KOURAND and has proved effective against the larvae of Muscidae and almost all embryos of intestinal worms.

4) Change of pasture; this is absolutely necessary, for though the eggs may be killed by frost, the embryos of the parasite, even if completely frozen, are able to regain their former activity as soon as the warmer weather returns, that is to say, Sclerostomata overwinter in the larval condition and infest the pasture again next year.

E. F.

964 - The "Berne" Fly (*Dermatobia egniventris*) Macquart, 1840 (2) in Brazil. — OLIVEIRA, M. (DE) (Ingénieur agricole en mission d'études du Gouvernement des Etats-Unis du Brésil en France, Ecole vétérinaire d'Alfort), in *Revue de zootechnie*, No. 9, pp. 913-915, figs. 3. Paris, June 1922.

The "Berne" fly is very common in the forest zones of nearly the whole South American continent, Mexico, and Central America. The Brazilian

(1) Cf. HOBMAIER, M. and TAUBE, B., Die Kochsalzmethode bei Untersuchung au Haustierparasiten, in *Berl. tierärztl. Wochenschrift*, Vol. XXXVII, 1921, No. 44, p. 521. (Author's note).

(2) The author calls this fly *Dematobia noxialis* Brauer (née Goudot) 1860, but the above name has the right of priority. (Ed.)

States most infested are Minas Geraes, Rio de Janeiro, São Paulo and Goyaz, next come Paraná and Rio-Grande do Sul. The warm, dry regions of N. E. Brazil are entirely free from this pest.

The fly attacks in decreasing order of frequency cattle, dogs, human beings, goats and sheep, only solipeds seem to be immune.

The eggs of the parasite are deposited on the abdomen of certain *Culicidae* and *Muscidae* and thus transported to the skin of the animals attacked. The larva, as soon as it leaves the egg, bores into the subcutaneous tissue leaving open the hole by which it has entered.

The "berne" fly does a considerable amount of damage, for no means of controlling it are as yet known. Cattle attacked by the parasite lose flesh and their hides are depreciated in value by the holes left by the insect. It is well to remember, although no explanation of the fact has hitherto been found, that black-coated cattle are more infested than others, indeed, the rearing of the Aberdeen-Angus breed in pastures surrounded by forest is a matter of great difficulty. In the author's opinion this is an additional reason in favour of the introduction into Brazil of the French Charollais breed

E. F.

965 - **Osteomalaxy in Brianz Cattle and Osseous Cachexy in Swine, Diseases caused by Malnutrition.** — BONAUGURI and CLERICI, I' Osteomalacia in Brianza e nel circondario di Menaggio, *La Clinica Veterinaria*, Year XLV, No. 5, pp. 215-224. Milan, April 1-30, 1922. — II SPARAPANI, G. C., I' cachessia ossea dei suini, *Allevamenti*, Year III, Part. 7, pp. 259-261. Palermo, July 25, 1922. — PROVENZALE, F., La vitamina e le malattie dovute ad alimentazione insufficiente, *Ibidem*, pp. 253-256.

I-II-III. — PROVENZALE gives an accurate account of all that is at present known respecting vitamins and the phenomena of avitaminosis, or diseases due to malnutrition, and expresses his opinion that the osteomalaxy of Brianz cattle studied by BONAUGURI and CLERICI and the osseous cachexy of swine (1) described by SPARAPANI must be classed under the head of diseases caused by malnutrition.

#### FOODS AND FEEDING

966 - **Quantitative Botanical Analysis of Artificial Stock Feeds.** — IJZENDAM, JOH. A., in *Verslagen van Landbouwkundige onderzoekingen, der Rykslandbouwproefstations*, No. XXV, pp. 1-83, fig. VIII 1's. Gravenhage, 1921.

The author begins by describing and discussing the methods hitherto employed in the quantitative analysis of artificial feeds. As regards those applied to linseed cake, he considers that the methods of PESCH and SCHAFFNIT are not practical. SCHAFFNIT's system is tedious even after modification by the author. It is suitable only in the case of linseed cakes. The same may be said for the methods of GRÉVILLIUS and SCHOUTE respectively. The Dutch method can be used only for the analysis of linseed and colza cakes. The author has come to the following conclusions regarding the methods adopted in the quantitative analysis of other foods: V. WEINZIERL's mechanical and optical analysis is not sufficiently accurate and is only suited to special cases; KUHN's method is excellent for the quan-

(1) See R. Aug. 1922, No. 840 (Ed.)

titative analysis of samples possessing a much higher, or lower, specific gravity than the food examined, which is of very rare occurrence; HINTNER's method is applicable if the particles of the substance analysed are coarse and easily recognised, and KOLE's method can be employed in analysing the testae in cotton-seed cake. ARTHUR MEYER's method, like that of HUSS, can be used if the constituents are measurable. The author's first method, which is based on the number of particles, may give very discordant results when the matter analysed differs but little in fineness from the substance analysed; he therefore tried to devise a method that did not depend upon the fineness of particles.

He first studied the cells in rice husks and found the average size of an epidermal sclerenchymatous cell to be  $100 \times 150$  micra. Having obtained this unit, he calculated the number of squares that each particle could cover in an area of  $150 \text{ micra}^2$ . To obtain the % of rice husks in the sample thus analysed, the author divided the total of the squares of all the fragments by the "normal figure" (viz the figure representing the number of  $150 \text{ micra}^2$  covered by the fragments in an area of  $1 \text{ cm}^2$  in the case of a sample weighing 1 gm. and containing 1 % of the substance analysed), or else, which was more satisfactory, by factors found for the purpose. This method is therefore not based upon the number of particles present in a given amount of the sample, but upon the surface covered by these particles.

*This method can be applied to.*

I. — *The quantitative analysis of the rice husks in rice meal, or other artificial foods.*

In the chapter entitled as above, the author studies the general method to be adopted for the determination of the "normal figure". He found in the course of his investigations that in order to avoid obtaining too great deviations in the results, it is advisable to take a sample weighing at least 1 gm. and only to consider mixtures containing 2.5 %, 5 %, 7 % and 10 % of the substance analysed leaving out of account those with 1 % and 20 %. The minimum number of particles investigated should be 200. The "normal figure" thus obtained for rice husks is 436.

II. — *The quantitative analysis of the barley husks in barley meal, barley bran and other artificial feeds.*

In the quantitative analysis of barley husks the author's method has to be based upon the area of the external epidermis cells. Therefore instead of macerating the sample with nitric acid and caustic potash, he boiled it for 30 seconds in aqua regia, then added 2.5 cc. of 15 % caustic soda and finally 7.5 cc. of glycerine (1 part water for 1 part glycerine). This stains the husks yellow and makes them easier to distinguish. The author was obliged to alter his method of finding the "normal figure" on account of the irregularity with which the barley husks occurred in the samples. He passed 10 gm. of unground material through a 1 mm. mesh sieve and then carefully removed with forceps all the barley husks from the mass left on the sieve after freeing them from all the adhering flour. The remainder was added, after milling, to the finer portion that

had passed through the meshes. From the entire mass he then took 1 gm. and subjected it to quantitative analysis. From the results obtained he was able to ascertain the total percentage of husks in the sample by adding to this partial result (made up to 10 gm.), the amount of barley husks he had removed after sifting.

The "normal figure" thus obtained is 65.

### III — *The quantitative analysis, of the pea-nut shells found in pea-nut flours and other foods*

The author's method can also be employed in the analysis of pea-nut shells, if the surface area of the fibres is used as a basis. The "normal figure" thus obtained is 25.8. When it is a question of the analysis of samples containing 10 % or 20 % of these shells two or more analyses should be made, as only  $\frac{1}{2}$  gm. can be used at a time which does not allow accurate results to be obtained. If the pea-nut shells are very large, the method devised for barley husks can be adopted. In order to find the total amount of husks present in feeds such as the flour of small seeds where small fragments of the shell occur together with pieces of the pea-nut itself, both the above mentioned "normal figure" and also the figure found for these mixtures can be used. This "normal figure" calculated on the basis of the superficial area of the hypodermic cells is 90.

#### *Quantitative analysis of foreign bodies found in artificial feeds*

The husks of rice and barley as well as pea-nut shells are frequently met with in linseed cake, wheat bran and many other feeds, and can be analysed by one of the above mentioned methods. Other foreign bodies, such as the endosperm of coffee beans, or the pods of cacao, are also of common occurrence.

The author tried making a quantitative analysis of these by means of his own method.

#### I — *Quantitative analysis of the endosperm of coffee-beans occurring in artificial feeds*

The author's method in this case had to be based on the superficial area of the endocarp cells. The "normal figure" is 36.5. If the fragments are large, the method suggested in the case of barley husks can be adopted.

#### II — *Quantitative analysis of cacao shells in artificial feeds*

In this analysis, the author takes as his basis the size of the sclerenchymatous cells and of the epidermis cells on the exterior of the seed integument. The "normal figure" is 27.7.

#### III — *Analysis of useful foreign bodies found in artificial feeds*

Useful substances as well as worthless matter are frequently met with in artificial feeds. It is sometimes worth while knowing the percentage of the valuable substances, but often they cannot be quantitatively analysed owing to the lack of any unit of measure, which only exists in foods that have not become altered during their preparation, or that have undergone such transformation as to have a constant composition. In the majority of cases, however, all that is necessary is to determine the presence of these foreign substances.

#### IV — *Quantitative analysis of the soy-bean content of artificial feeds.*

In the author's method of analysing pieces of soy-bean, the cells of the palisade-tissue are measured. The "normal figure" to be used is 5.7. If the soya-bean is mixed with a food that is not very resistant to chemical maceration, it is best to take a large number of samples, or else to plot out on a larger surface the number of squares covered by the fragments, as this is of great assistance in calculation.

.V. — *Quantitative analysis of the degree of purity of linseed cake and linseed bran.*

Percentage of substance analysed	Amount analysed	Superficial areas measured	Normal figure
Straw 5 % . . . . .	1 gm.	7.2 cm <sup>2</sup>	22
Small gramineae 10 % . . . . .	1 "	3.6 "	55
<i>Setaria viridis</i> 10 % . . . . .	1 "	3.6 "	35
<i>Chenopodium ambrosioides</i> 10 % . . . . .	1 "	4.8 "	19.5
<i>Chenopodium album</i> 5 % . . . . .	1 "	9.6 "	18.7
<i>Sinapis arvensis</i> 10 % . . . . .	1 "	4.8 "	18
<i>Camellina</i> 10 % . . . . .	1 "	8.4 "	18.5
<i>Spergula</i> 10 % . . . . .	1 "	7.2 "	21
Gramineae of average size 10 % . . . . .	1 "	10.8 "	12.6
	1 "	12 "	
	1 "	14.4 "	
<i>Centaurea</i> 10 % . . . . .	1 "	7.2 "	18.2
<i>Brassica</i> 10 % . . . . .	1 "	6 "	21
		6 "	
<i>Gallium</i> 10 % . . . . .	1 "	8.4 "	20.3
<i>Polygonum</i> 10 % . . . . .	1 "	8.4 "	19.4
<i>Agrostemma</i> 10 % . . . . .	1 "	12 "	14.6
<i>Vicia</i> 10 % . . . . .	1 "	10.8 "	12.2

The author's method is based upon the measurement of the area occupied by the impurities and from this he deduces the degree of purity. The advantage of this system lies in the fact that a larger number of impurities are used in estimating the area which they cover. The quantitative analysis of a sample of linseed cake takes about an hour if this method is adopted.

The Table gives the "normal figures" found by the author for most of the impurities met with in linseed cake.

By means of these "normal figures" it is possible to estimate the degree of purity of linseed cake. Another Table gives the different factors employed in the analysis of various impurities, the analysis being based on a surface of 1 cm<sup>2</sup> divisible by 1 to 9 rows.

The author also gives a Table to assist calculation of results.

Stress is laid upon the fact that the success of this method chiefly depends upon the accuracy of the "normal figure" used. F. S.

967 - **Figs as Food for Livestock.** — See No 989 of this *Review*

968 - **Selection as a Means of improving Domestic Animals.** — FRATEUR, J. L. in *Annales de Médecine vétérinaire*, year 67, No 7, pp 289 311 Brussels, July 1922

Selection was formerly governed by the one great theoretical principle that "like begets like" Now however selection as applied to stock-breeding may be defined as the reasoned choice of progenitors with a view to the improvement of the race It is a question of choosing animals capable of impressing their own good points upon their progeny, therefore the whole value of selection depends upon the prepotency of the parents, i. e. their power of transmitting their qualities to their descendants

Selection acts only on hereditary characters, on the genotype which is wholly distinct from the environment and does not depend upon environment for its transmission and hence for its effect in improving the breed

The question has been asked whether selection is only effective in the case of native breeds The old indigenous races of a region are homozygous as regards a certain number of characters which are therefore fixed characters This is due to the fact that breeds naturally protected from any considerable amount of crossing have become progressively and automatically pure as regards a certain number of characters which are then for the most part homozygous, or duplicated

Selection should be more effective with these simple types than in the case of breeds possessing complicated characteristics How is it possible to select from material where all the individuals have the same genotype, that is to say, are pure? In all breeds, even the oldest, there are always a certain number of heterozygous characters, that is to say with two dissimilar sets of factors, and when it is desired to use farm stock for improving the domestic animals it is always necessary to begin by selecting individuals that have retained certain given characters of the breed indigenous to the country

The breeder will thus have at his disposal a large number of homozygous forms which will form the basis on which to build up pure lines Finally, the author states the rules, which govern heredity and make it possible to obtain accurate results of practical utility by means of selection He draws a distinction between phenotypic and genotypic selection

#### 1) *Phenotypic selection*

Phenotypic selection has been advocated because the effect of environment can continue for one or two generations, being handed down by the progenitors, especially those on the maternal side This however cannot be a question of hereditary transmission properly so-called, for the effect disappears after a certain lapse of time when the effect of the environment which gives rise to the variation has ceased Selection only gives good results when systematically carried out Methodical selection offers the best opportunities, not only in the case of phenotypes but also in that of genotypes (definitive selection) The following are some practical rules to assist in selection

Individuals should be chosen which present extreme variations. These

individuals should be isolated and allowed to interbreed only amongst themselves. Improvement by selection nearly always means the isolation of a specially good genotype, its propagation and further selection, so that it can eventually replace the original breed which in its entirety is less satisfactory. Therefore, in order to succeed, the selected individuals must be subjected to the most rigorous isolation. The best phenotypic results are obtained as a rule when isolation has been most complete.

## 2) *Genotypic selection.*

Genotypic selection is based on the hereditary factors of the required characters. It is a scientific operation, whereas phenotypic selection is empiric.

The theoretical aim of selection is to obtain pure lines, that is to say a group of individuals with the same hereditary formula and all the factors of this formula in duplicate. In the case of our domestic animals, it is impossible in spite of sex separation to obtain really pure lines. The appended Table shows the progressive improvement of autogamous individuals. The author mentions in this connection the analogy of the results obtained in the case of autogamy and absorption crossing.

The final object of all selection is therefore the isolation of lines that are pure, or capable in the course of time of producing pure lines. Selection possesses no creative power, it can only isolate and sift. Once however the products of the sifting have been obtained, they must be kept free from all contamination, otherwise the work will have been in vain.

*The work of genotypic selection.* — The aim of selection is to obtain offspring similar to their selected parents. Therefore only those males should be kept for breeding purposes which probably possess the genotype of the desired characters. Pure lines can only be attained by means of such males.

The different breeds of animals however are formed of a mixture of genotypes that are very rarely pure even as regards their extreme variations. Fortunately the knowledge we now possess is already sufficient to be of great assistance in obtaining animals with pure characters all homozygous, or having a duplicate set of similar factors, in which case, there are no discarded individuals. In practical work, several cases may arise, thus:

1) The hereditary characters may be well known. When these characters are the result of recessive factors, or even of extreme variations of a quantitative nature, they are pure.

When on the contrary, the characters depend on dominant factors, they are impure in the majority of cases. After the second generation there will however be a certain number of homozygous individuals, from which selection can be made, but it is better to discard all individuals that are heterozygous as regards the required characters. To do this recourse must be had to the purity reaction.

On the other hand, in the case of quantitative factors, it is often pos-

sible to distinguish between pure and impure factors. The extreme variations of these characters are pure.

2) The genetic nature of the characters to be selected may not be known.

In this case, some of the best individuals are chosen and mated together for several generations the results obtained in each generation being carefully recorded. The percentage of rejected individuals in each generation serves to indicate the course to be followed. After the third generation there should be a sufficient number of homozygous individuals to allow the trial of the purity reaction.

3) It may happen that only one of the parents (the male, or the female), possesses in a perfect degree the desired character.

In this case selection must be combined with absorption crossing. In the next generation, various results may be obtained.

a) the character of the bull may have been transmitted to all its progeny. This shows that the factors of these characters are dominant. All the offspring of the first generation are however mixed, and if the new selected variety is to be fixed, it is necessary to carry out absorption crossing.

b) the character of the bull may have been transmitted to none of its progeny. This shows the character to be due to recessive factors and the individuals of the first generation must be re-crossed with the same bull and a new selection made of all the descendants having the character of the sire; in this way a small nucleus of individuals is formed which are crossed together. The character is then fixed.

c) in the  $F_1$  a character may be obtained that is intermediate between that of the bull and cow respectively, in this case also an absorption cross must be made

The application of these general rules must vary according to circumstances. The breeder should however always keep in mind that the object is to obtain a homozygous line. Although this method does not always yield good results and entails a certain amount of danger from in-breeding, the author is of opinion that in many cases it is the only one to adopt and is also the surest way to arrive at the desired result.

*Table showing the autonomous purification of autogamous individuals by crossing an individual having the pure A character with an individual not possessing this character.*

Crosses	Results			Pure %		
	A					
P $A_2$ + P				0	0	0
$F_1$ + $F_1$	25 $A_2$	50 A	25 $a^2$	50	25	25
$F_2$ + $F_2$	37.5 $A_2$	25 A	37.5 $a^2$	75	25	25
$F_3$ + $F_3$	43.75 $A_2$	12.5 A	43.75 $a^2$	87.50	43.75	43.75
$F_4$ + $F_4$	46.875 $A_2$	6.254 A	46.875 $a^2$	93.75	46.875	46.875



*Absorption Crossing of heterogamous individuals*

Crosses	Results		Pure %		
	A		Total A <sub>2</sub>		
P A <sub>2</sub> + P			0	0	0
F <sub>1</sub> + F <sub>1</sub>	50 A <sub>2</sub> ;	50 A	50	50	0
F <sub>2</sub> + F <sub>2</sub>	75 A <sub>2</sub> ;	25 A	75	75	0
F <sub>3</sub> + F <sub>3</sub>	87.5 A <sub>2</sub> ;	12.5 A	87.5	87.5	0
F <sub>4</sub> + F <sub>4</sub>	93.75 A <sub>2</sub> ;	6.25 A	93.75	93.75	0

The number of homozygous individuals  $x'$  in each generation is expressed by the formula  $x' = x + \frac{y}{2}$ , in which  $x$  = the number of homozygous individuals in the preceding generation and  $y$  = the number of heterozygous individuals in the preceding generation.

969 — Correlation between Lack of Nitrogen in Soil and Raising of Livestock. — See No. 926 of this Review.

STOCK  
BREEDING

970 — The Live-Stock of the Tavoliere di Puglia (1). — SPEZZATI, M., in *Allevamenti*, year II, No. 12, pp. 414-416, fig. 1. Palermo, December 31, 1921; year III, No. 3, pp. 65-70, figs. 5. Palermo, March 1922.

CATTLE. — These are of the Podolian breed; bulk medium; coat white; long lyre-shaped horns; dewlap long; withers sunken; legs long. The animals are fed sparingly being turned out to grass and only given a little straw and some handfuls of hay. They are kept almost entirely in the open and driven into rough shelters during the coldest part of the winter. When no longer able to work, these cattle are usually slaughtered. The author draws attention to the fact that if the oxen were kept until they were 9 or 10 years old instead of being sent to the butcher's when 4 or 5, and were then given a fattening ration for 30-40 days, such as grass supplemented by hay, oats or ground beans, these animals would put on much flesh at smaller expense, the beef would gain in flavour and higher profits would result.

HORSES. — These are of Eastern origin, their ancestors having been imported by the Greek Colonists. Fifty years ago many pure-blood horses were bred and sold in large numbers at fairs held at Foggia, Andria, and Gravina, chiefly to the Military Commission. Subsequently, machine-

(1) Information regarding stock-breeding conditions in Italy and the Italian Colonies can be obtained from the following original articles: R. JAPPA, The Cattle Industry in Italy at the Present Day, R. May 1914, pp. 598-606, June 1914, pp. 712-716; E. MASCHERONI, The Rearing of Donkeys and Their Crosses with Horses in Italy and Her Colonies, R. Feb. 1920, pp. 129-138, figs. 16, and in the following articles reviewed: R. 1901, Nos. 1824, 2207, 2811; R. 1912, Nos. 321 and 684; R. 1913, Nos. 330, 702, 708, 709; R. 1914, Nos. 352, 357, 546; R. 1916, Nos. 357 and 927; R. 1917, Nos. 729 and 1325; R. 1918, Nos. 538, 647, 665, 777; R. 1919, Nos. 220, 224, 414, 490, 943, 953, 1182; R. 1920, Nos. 93, 277, 522, 779, 894; R. 1921, Nos. 180, 316, 318, 412, 536, 656, 658, 742, 743, 842, 935, 939, 947, 1029, 1103, 1143; R. 1922, Nos. 84 and 188.

threshers became common, so that fewer horses were needed on the farms for threshing, the pastures decreased and were turned into vineyards which did much injury to horse-breeding, and the industry rapidly declined. It no longer paid the breeder to reserve his finest colt for a stallion, so that he applied for the services of the stallions kept at the Government Stations. These animals were chosen without any unity of aim. On the other hand, breeders having no well-bred stallion continued breeding the local race which is very strong, but soon began to show signs of degeneration. The English and Arab stallions however proved excellent sires provided sufficient care was given to the foals. The author much regrets that the want of a clear aim in breeding has resulted in mixing the different races. He is of opinion that the breeder of the Apulian horse should set two objects before him : 1) the production of a farm-horse of the Breton type ; 2) the production of a riding and a light draught animal suitable for military purposes.

**SHEEP.** — Travelling sheep-breeding was formerly much developed and the flocks coming down from the Abruzzi occupied at least 200 000 hectares, or two-thirds of the "Tavoliere". Subsequently the animals were greatly improved both by repeated crossing with Merinoes and by the fact, that being transported by rail, they were spared the fatigue of long journeys on foot. When the breeders had succeeded in obtaining wool of greatly superior quality, they had to face severe competition from the Australian and the Argentine ; this dealt a great blow to Apulian sheep-breeding and in a few years many of the animals had to be slaughtered and much of the pasture-land was ploughed. Sheep are however still reared in large numbers in the Province of Lecce, near Tarento, in the Province of Bari, in the neighbourhood of Matera, and in Basilicata near Altamura. In each of these provinces a different variety of sheep is raised, but the distinguishing characters are of slight importance. The animals are somewhat larger than merinoes and have a long, fine fleece parted down the middle. Their meat is a more vivid pink colour than that of other breeds and the fat is a transparent white.

The author believes that sheep-breeding might again become an important industry in Apulia ; large flocks of merinoes, known locally as "gentile" or "spagnola", should however not be kept. The sheep to choose is the "long-wooled" or "soft-wooled" animal that does not need to migrate to the higher land, being resistant to the summer heat of the "Tavoliere". Each farmer should keep a small flock of these sheep to graze on his fallow land and by the road-sides.

**PIGS.** — The pigs of Gargano are white, have little hair, a slightly arched back, long snout, and short legs ; they often weigh 2 quintals or more. Their meat is of fine quality and marbled, the fat is white and firm.

Over 10 000 animals are reared annually on the promontory whence the breed takes its name. From November to early June the pigs feed on the Gargano pastures and then descend to the plains, where they are turned out into the barley, wheat, and bean stubble fields ; in September

they are driven into the oak woods of Mt. Gargano to feed on the acorns. If the crop is scanty the animals are put into sties and given beans and then maize until they are ready for the butcher.

F. D.

971 - **The Development of Stock-Breeding in Sardinia.** — VALLISNERI, A., in *L'Italia Agricola*, Vol. 59, No. 6, pp. 194-200, figs. 5. Piacenza, July 15, 1922.

**CATTIE.** — Two methods have been adopted in Sardinia with a view to improving the cattle-breeding industry of the island: 1) crossing the dual purpose animals chiefly found in the north of Sardinia with a Swiss bull, in order to obtain good beef and dairy cattle; 2) crossing the native cattle with the Modica breed so as to obtain draught animals. The pure native cattle are reared only in the centre of the island or on the east and north coasts, in poor districts where they cannot be replaced by better stock. The cattle are used for ploughing and when they can no longer work are sent to the butcher.

The Modica breed is gradually being superseded by the Swiss for the improvement of native cattle. Swiss cattle, if bred pure, in Sardinia lose many of their good qualities and become inferior to their hybrids. The latter, according to a series of measurements of adult cows taken by the author are 127 to 139 cm. in height at the top of the withers; their conformation is good. The cows yield from 20 to 25 litres of milk daily, but only during four months in the year, dating from the calving time at the end of the winter until the pastures become dried up.

Throughout the summer only a few grammes of milk are produced, but the suckling calves keep the teats active so that should rain fall in September, which is of rare occurrence, there is also an autumnal lactation period. The characters of these cross-bred cows are quite fixed and as the latter are triple purpose animals and very adaptable, they are now imported to improve the native breeds of Sicily and the Italian peninsula. Many have been introduced to replace the stock in the invaded provinces where they give entire satisfaction.

**SHEEP AND GOATS.** — Sheep are bred throughout the island, fixed flocks being kept in the coast districts, and travelling flocks in the central region. Milk is their chief product. The Sardinian sheep is a small animal about 60 to 70 cm. in height and the mountain breed weighs about 20 kg. and the plain breed 30 kg. It is thrifty, a good walker and excellent grazer. The fleece is light (weighing 600 to 700 gm.), the wool is coarse and unequal, dry and scanty. The meat of the adult sheep is inferior in quality, but that of the lambs is excellent. Lactation lasts from about 6 to 8 months with an annual average milk yield of about a quintal, which is a large quantity if the poor pastures and lack of care and shelter are taken into account. From 18 to 25 p. c. of cheese, according to the kind, can be produced from the milk and "Ricetto" is also made. The ewes' milk is made into butter of fairly good quality.

"Pecorino sardo" is the type of cheese usually manufactured. It found a rival in the "tipo pecorino", a cheese made from cows' milk, but this in its turn has been replaced by Roquefort with its larger out-

put, as the latter cheese is manufactured in Sardinia by several French Societies.

Sardinian sheep should be selected and not crossed with other breeds.

In the steepest parts of the islands goats do better than sheep, and they yield milk at a season when it cannot be obtained from any other animals. The flesh of the kids is excellent.

Pigs. — The herds of swine are decreasing in proportion as the work of deforestation continues. The Sardinian pig greatly resembles the wild swine; its coat is grey, or more rarely black, fawn, or pied. It is small (40 to 65 kg.), short and fattens easily if fed on both grass and acorns. Pigs fattened at home may weigh as much as 150 kg. when 2 years old. Large cheese factories have recently been started in the island and an attempt has been made to utilise their waste products by pig-breeding. Several foreign breeds such as Yorkshires, Berkshires and Casentaux have been introduced to improve the native animals.

A series of experiments and tests is still in progress (1) F. D.

972 — **Stock-Breeding in Greece.** — *L'Economiste d'Athènes*, Year 1, No 23, pp 356-357 Athens, April 15, 1922

The stock-breeding industry is well developed in Greece. Sheep and goats are the animals reared in the largest numbers as they find a plentiful supply of food in the extensive mountain pastures.

At the end of the War the number of sheep and goats had decreased 30 %. This was due partly to the unusual amount of meat consumed by the troops of the Greeks and the Allies, as well as by the hundreds of thousands of Greek and Serbian refugees, and partly to the fact that the civil population were obliged to eat meat owing to the short supply of bread during the period of hostilities.

There are also fewer horses and mules in the country as many were commandeered for the Army.

The live-stock reared in Greece had always been sufficient to meet the requirements of the inhabitants. The value of the stock and farm products imported before the War was never higher than 4 to 6 % of the value of the home production. On the other hand, Greece used to export hides, wool and cheese to the value of several million francs a year.

(1) As regards stock breeding in Sardinia and especially the rearing of horses, mules and donkeys, see R Feb 1919, No 224, R Mar 1921, No 316; R Sept 1921, No 935; R Nov 1921, No 1142, R Dec 1921, No 1250.

The volume of *L'Italia agricola* under discussion is entirely dedicated to Sardinia and in addition to the article summarised above contains the following papers: F. BLANDINI, One of the Agricultural Troubles of Sardinia, Dust Covered Land — G. HINCK, La Nurra: Roads and Drainage — F. BLANDINI, The Varieties of Wheat Cultivated in the Province of Cagliari, trigu moru (summarised in R Aug 1922, No 826) — O. GERVASO, Drainage and Irrigation in the Campidano d'Oristan — B. VANZI, Horse breeding in Sardinia — LIUZZI C., Viticulture in Sardinia during the last fifty years — G. SANNIO, Cheese Manufacture in Sardinia, A Model Cooperative Dairy — MANCONI, Cork Growing and the Cork Industry Sardinia. — B. ORRU, Small Agricultural Industries in Sardinia. (Ed.)

Although poultry-keeping is much dearer, transport is more expensive and the general cost of living has risen, Greece is still able to satisfy all internal demands for live-stock produce, the gradual decrease in the beef supply being counterbalanced by an increased amount of pork.

In 1920, the value of the live-stock produce imported from abroad was 5 % of the value of the native production.

On the whole therefore Greece can keep its own meat market well supplied. F. S.

973 - **A Study of the Argentina Cattle Crisis.** — LIGNIÈRES, J., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 8, No. 20, pp. 570-574. Paris, 1922

The Argentina breeders are much concerned at the present crisis in the cattle trade which is characterised not by a rise in prices, but by a general stagnation of business. The causes of the crisis are several: 1) the necessity for economy which has caused all nations to increase their own production and deal with their own Colonies rather than import from abroad; 2) the unfavourable condition of the exchange rendering it difficult to purchase Argentine produce; 3) the accumulation during the War of enormous reserve stocks that have often greatly deteriorated and have in any case fallen in price; 4) the competition of Australia, New Zealand, Canada, Uruguay and Brazil

The result is that South American Frozen Meat Companies are obliged to reduce their purchases and the breeder is left with his stock on his hands. After having thus stated the causes of the crisis, the author discusses the remedies which have been suggested, some of which are of a local character, whereas others would be more radical and far-reaching. In this latter category come the opening up of new markets, propaganda, and the sale of the reserve stocks. F. S.

974 - **The Future of the Grazing Industry in Brazil and its Present Crisis.** — MORAES BARROS, P. (DE) in *Revista da Sociedade Rural Brasileira*, No. XXIV, pp. 324-328, São Paulo, June 1922.

The present crisis through which the grazing industry is passing must be attributed to three causes; 1) the replenishing of the depleted European flocks and herds; 2) the existence of large army stocks of tinned and frozen meat left on the continent at the end of the War; 3) the restriction of meat consumption imposed upon the people by the Governments of the belligerent nations.

This crisis can however be only of a transitory character, for the demand for meat and all the other necessities of life naturally tends to increase and it is easy to foresee that when once equilibrium has been restored in the congested supply market the sales will constantly and progressively rise as they did before the War.

The author, who is President of the *Sociedade Rural Brasileira*, has dedicated his paper to the President and Members of the Government of the State of Matto Grosso. He is convinced that Brazil will play a great part in this trade revival, for whereas stockbreeding shows signs of decline in the largest American States (the United States and Argentina) owing to the wide tracts of pasture lands that have been ploughed up for

intensive farming, the most favourable conditions for the rapid development of stock-rearing are to be found in Brazil, especially in the State of Matto Grosso. In order to be able to benefit from this privileged position at the right moment it is however necessary to take certain preliminary steps during the present crisis.

In the first place, all the factors must be eliminated that hindered local production before the War.

The native breed of cattle finds disfavour on the overseas markets owing to the large admixture of Zebu blood. This defect could be remedied within 5 years if the owners would set aside 10 % of the proceeds of their annual sales for the gradual replacing of their present bulls by Rio Grande animals, which are totally immune from red-water (*tristeza*). An active propaganda should be made in the centres of production.

Another obstacle that should be removed is the great burden of taxation. Brazilian meat is taxed to such an extent before it reaches the market, that it must of necessity be sold at a price which prevents competition with foreign products.

The author gives statistical data to support his views and draws the attention of the Federal Government and the Governments of the different States to the paramount importance of reducing these taxes in the interest of national trade.

In order to derive full benefit from the favourable cattle-breeding conditions in Matto Grosso, the means of communication between that State, São Paulo and Rio Grande do Sul must be improved. São Paulo is the centre of important industrial undertakings and of the movement of capital, whereas the latter State possesses breeding stock belonging to the best European races.

E. F.

#### HORSES

975 — **The Horses of the French Sudan.** — WILBERT, J., in *Revue de Zootechnie*, No. 9, pp. 843-859, with illustrations. Paris, June 1922.

In the colonies of Upper Senegal, the Niger and Upper Volta which form part of French West Africa, there are some 70 000 horses. The breeding of these animals has been left almost entirely in the hands of the natives and has suffered from their carelessness and ignorance. The few and inadequate attempts made by the local Breeding Service to improve the breed have met with relatively little success, but good results could be obtained if the animals were liberally fed and some general hygienic precautions taken. The native breeds of horses are of various types owing to unsystematic crossing, neglect and the effects of environment. The author has however been able by means of a thorough investigation based on accurate measurements to distinguish the 4 characteristic types.

1) Rectilinear, forehead flat, eumetric and medio-linear corresponding to the *Arab breed*. Its sole representative in the French Sudan is the Air horse which probably came from Judea and Syria.

2) Convexilinear, forehead convex, eumetric and mediolateral corresponding to the type of the *Mongolian breed*. This horse came from the Mediterranean region and was introduced by the Berbers. The type in-

cludes the subraces of Hoah, Sahel; Beledougou Kaminiandougou, Guenickalari, Minianka, Guidimaka and Kasso, viz., the greater number of the horses of the Western part of the Colony. From the practical standpoint the most important is the Hoah sub-race.

3) Convexilinear, hypermetric and longilinear corresponding to the *Dongolawi* race and including numerous subraces with characters in common (Djerma, Gondo, Liptako, Songhai, Yatenga, Boulssa, Boussomma, Torodi, Yagha, Bobo-Oule, Nounougou, and Boussangha). The horses of this type are excellent draught animals and can do heavy work, but have become apathetic and wanting in resistance as a result of the damp warm weather that occurs during the greater part of the year.

With the exception of the Mechdonf, Mavka, and Peuhl Moors of the Sahel and Gourma, no other native tribes breed horses which is now a matter of little importance, as since the pacification of the country the cavalry corps has been supplied.

4) Concavilinear, forehead dished, ellipometric and mediolinear. This breed is very similar to the Siginni race and to the Coto-coli pony as found on the borders of Dahomey at the extreme south of the Colony.

The author gives a short description of each of the above-mentioned races. Their habitat and zone of distribution are shown on a special map prepared for the purpose.

For this reason, it would be necessary to limit the work of selection to the improvement of a few breeds, and owing to the nature of the inhabitants and the conditions of the country, breeding centres should again be established, or only approved and licensed stallions allowed to be employed. In the latter case, more prizes ought to be offered to breeders who should be allowed the opportunity to buy selected animals from Stations where the horses become naturally acclimatised. Service Stations under veterinary supervision and managed by European, or native, experts, should be established in each breeding district.

The improvement of the Sudanese horses was actually begun as long ago as 1896, but met with little success. A second attempt led to the establishment of the Kowlikoro Station, which was first started for horses of Arab-Berber origin from the east of the Colony, and to measures being taken for the protection of the Mongolian breeds which supply the stallions entrusted to the local Authorities. Another attempt was made on a larger scale, but was abandoned in 1910, for although a certain amount had been accomplished, the methods adopted were not satisfactory. The results obtained however are useful to anyone wishing to profit by a horse-breeding experiment in French West Africa.

E. F.

976 - **Improvement of Breeds of Horses in Italy.** — I. CELLA, R. (Direttore della Stazione di mont. equina di Pisino, Venezia Giulia), Il cavallo di Brioni come miglioratore dell'allevamento equino istriano, *Il moderno zootatro*, parte scientifica, Series V, Year XI, No. 1, pp. 46-47. Bologna, January 1922. — II. BAZZOCCHI, A., La produzione equina in Romagna (1), *Allevamenti*, Year III, Part. 4, pp. 105-107, figs. 3. Palermo, April 1922.

The author is of opinion that the best horses for Istria, whether for agricultural purposes, riding, or driving, are to be obtained from the Is-

lands of Brioni. These animals belong to the Hoflinger breed, which is reared in the Tyrol and was formerly improved by crossing with Arab sires. The native Istrian mares especially those resulting from Eastern or Lipizan (1) crosses, when mated with a Hoflinger stallion, produce excellent hybrids that resemble the paternal type more than the maternal and possess large, strong hoofs. On recrossing these hybrids with a Hoflinger stallion, an animal is obtained which fulfils all the requirements of the Istrian peasant and makes a good army horse. The Hoflinger horse and its crosses mature early, the former reaching maturity at 3 years of age.

II.— A short time ago horse-breeding in Romagna was rather a pastime than an industry. The Pineda breed of Ravenna alone was to some extent fixed and homogeneous. Bosnian and Croatian horses were subsequently introduced and later so-called Hungarian horses. The general confusion was also increased by the lack of unity of aim in the selection of stallions for the Government Stud Stations.

During the War however a very successful experiment was made in introducing the Sardinian horse, and breeders began to turn their attention to rearing trotters and, to a less extent, heavy draught animals. Some good Belgian stallions have been imported for the production of heavy weights, but there are no brood-mares. The offspring of the small local mares are loose-limbed. The present brood-mares, especially those of Sardinian blood, are more suited for the production of trotters. The author gives an account and the pedigrees of some of the imported stallions and race-horses. He recommends the importation of animals to increase the stock of brood mares and considers that if his programme were carried out, Romagna (Province of Ravenna and of Forlì), might become a very important centre for breeding light cart and carriage horses. F. D.

977 - **The Murmur in the Uterine Arteries of the Mare.** — RICHTER, J. (Director des Instituts für Tierzucht und Geburtshilfe der tierärztlichen Hochschule in Dresden), in *Berliner tierärztliche Wochenschrift*, Year XXXVIII, No. 10, pp. 109-111, bibliography of 13 works. Berlin, March 8, 1922.

During the last twenty years, the diagnostic characters of pregnancy, especially in the case of cows, has been the subject of much research. Clinical methods of examining the vagina and rectum have superseded ABDERHALDEN'S system which has proved of little practical use.

The technique employed in these examinations is now fixed and generally practised in the case of cows but hitherto no sufficient data have been available as regards horses.

The method advised by ALBRECHT (2), viz. local auscultation from the outside of the body, gives no practical results, but the method suggested by the author and based on internal manual examination is very successful. It is well-known that on introducing the hand into the rectum of a pregnant cow and placing the finger-tips upon the median artery of

(1) See foot note to No. 961 of this Review. (Ed.)

(2) No. VII, Part II of *Handb. d. tierärztlichen Chir. u. Geburtshilfe*, 1913, p. 230. (Author's note).



the uterus, a vibration of the arterial wall is clearly felt and a murmur resembling *ssst — ssst — ssst* — heard, which is an almost infallible sign that the animal is in calf.

By adapting this technique to the differences in the structure and position of the uterine blood-vessels in the mare, the author has been able to hear a similar murmur emitted by the artery of the uterus. It differs slightly in character from that heard in the case of the cow, bearing more resemblance to the sounds *sss — ss — s — sss — ss — s* etc. The author states that this vibration is of great use in the diagnosis of pregnancy and quickly ceases after the mare has foaled. E. F.

978 — **Mule-Breeding in Lower Poitou.** — GRAU, A., in *Revue de Zootechnie*, No. 10, pp. 1-11, illustrated, Paris, July 1922

There are large mule-breeding stations in Lower Poitou, the district including the *arrondissements* of Fontenay-le-Comte, Niort and Melle.

The author describes the ass and the mare used in the cross, and also the adult mule.

The sires are asses of the large Poitou breed. These animals are from 1.30 m. to 1.50 m. in height, having very large heads and very thick legs, and long open ears fringed with curly hair. The hair of the coat is long and shaggy, dark-chestnut in colour (lighter on the abdomen), and forms a kind of fleece which entirely covers the body giving these donkeys a characteristic appearance. An ashen-grey band encircles the head a little above the muzzle.

The great height of this breed appears to be due to the very calcareous soil, for the Poitou donkey only develops properly on the Jurassic plains in the district and on the recent alluvium of the marshy areas of La Vendée.

During the first month the foal is the object of the greatest and most constant care, and afterwards it accompanies its dam to grass and is not weaned before the age of 9 to 10 months. It is then given almost the same food as the adult animals, viz. lucerne, clover and lupin. The young donkeys are thrifty, for until the period of service, viz., the age of 2 or 3 years, they only eat 5 to 6 litres of oats a day. The service season is from February to July, and after each mating, the donkey is given an additional litre of oats.

Except during this period the adult animals are given no oats for they do no work and are always kept in the stable owing to their stubborn bad-tempered and sometimes dangerous dispositions; they are thus however predisposed to certain skin-diseases and to swelling of the feet. The author considers that a moderate amount of exercise and the observance of hygienic precautions would have a salutary effect upon the health of the donkeys. If each animal were turned out into a grassy enclosure communicating with the stable, the foot trouble would be avoided. It would however be necessary to surround the enclosures with walls high enough to prevent the donkeys seeing and attacking one another.

The horses used in breeding Poitou mules belong to the Friesian race introduced into the region at the beginning of the 17<sup>th</sup> century. They

are from 1.62 m. to 1.65 m. in height, their legs are powerful and covered with hair which is very thick at the lower extremity; the mane and tail are thick, the hoofs large and flat. Individuals with long head and ears, high withers and strong neck are preferred as they produce fine vigorous mares bearing strong mules. By means of continuous selection, the breeders have succeeded in obtaining a special type of mare particularly well-adapted for mating with the donkey. After they are served, the mares have no special treatment, until pregnancy is far advanced, when they are kept in the stable or left in the field and not obliged to work. As mating takes place in the spring, the mares foal the next year from April to June. After foaling, the mare is given grain, hay and warm drinks, which encourage lactation, and is afterwards put into the field together with the foal. Weaning takes place in November, the young mules of a year old, called locally *jetons* and *jetonnes*, are fed during the winter on artificial forages and carrots; with the return of spring they are turned out into the fields where they find clover and lupins. When 15 to 18 months old, the *doublons* or *doublonnes*, as they are termed, are harnessed to a cart in company with an old mare and do a moderate amount of work which develops and strengthens their muscles. Mules that have reached the age of 3 to 4 years are kept in the stable, given every care and fed liberally to make them put on flesh rapidly; at the end of the year they are sold at the fairs.

A full-grown mule is from 1.45 m. to 1.60 m. in height and weighs from 300 to 600 kg., it can do as much work as a horse, especially in damp, warm climates such as are very injurious to horses.

Over 20 000 mares are served annually by donkeys and of these about one half are fertilised; thus the number of mules born in the district every year may be estimated at from 10 000 to 12 000. In 1884, a Stud Book was started and a Breeding Syndicate was founded in 1902. E. F.

#### CATTLE

979 - **The Saint-Tropez (France) Breed of Cattle.** — GOUIN, R., in *Revue de Zootechnie*, No. 10, pp. 59-64. With illustrations. Paris, July 1922.

Saint Tropez is the ancient capital of a part of the territory of the Côte d'Azur situated between the mouth of the Argens (near Fréjus), and the Gulf of Giens. It possesses a special breed of cattle similar to that of the Camargue marshes, which is in the opinion of the author of African origin and not descended from the Italian Podolian race as has been maintained in other quarters.

The Saint-Tropez cattle are small (1.30 m. to 1.50 m. in height), they have a glossy coat generally black, but sometimes brown, and sometimes spotted with white. The mucous membranes are black and the horns and hoofs very hard. The horns are inclined slightly upwards, the loins are straight, the hocks rather close together, and the rump is sometimes higher than the withers. The cows have small, brown udders and yield only sufficient milk for suckling their calves.

This breed is used solely for work. The animals are not docile, but a special method of yoking is employed and they are controlled by the

voice. Local changes in cultivation and the disappearance of pastures have led to the practical extinction of the race. Reintroduction is not worth attempting, for even if the initial difficulty of obtaining sufficient breeding stock could be overcome, the conditions to which the Saint Tropez cattle were specially adapted have undergone such changes that it would be more advantageous to replace them by a dual purpose breed suited to the altered environment. E. F.

980 — **The different Thicknesses of the Skin in certain Breeds of Cattle.** — IMBODEN, J. G., in *The Breeder's Gazette*, Vol. LXXXI, No. 22, pp 726-727. Chicago, June 1, 1922

Certain breeders consider that the lack of resistance shown by Shorthorns to both cold and wind is due to their thin skins, for Hereford and Aberdeen-Angus cattle which have very thick hides are even able to graze during a storm without experiencing any ill effects. The author resolved to test this statement and collected data showing that the absolute hide yield is greatest in the case of the Herefords, the Aberdeen-Angus and Shorthorns following in decreasing order; the percentage is higher for bulls than for calves, and for one-year old calves than for two-year old animals.

Given equal quantities, the hide percentage of a thin calf exceeds that of a fattened calf of the same age. Climate and geographical position also have a considerable effect upon the hide yield, for cattle reared in southern regions where the heat is intense have thicker skins than those bred in the north, although the northern cattle have longer and more shaggy coats.

This difference is explained by breeders on the assumption that the thick skin of the southern cattle protects them from the rays of the sun and from insect attack, whereas a shaggy coat would be of little use. In the north and northwest, where there are fewer external parasites, the cattle do not need a thick hide, but require a heavy coat to enable them to defy the winter cold. The quality of the leather does not necessarily depend directly upon the general condition of the animal and therefore a very good yield of hides can be obtained from cattle that have received but little attention. There is no practical difference between the commercial value of the hides of thin or of fattened calves. E. F.

981 — **Experiments on the Industrial Crossing of Southdown Ram × Limousin Goat.** — VOITELIER, CH. and DEGOIS, E. in *Revue de Zootechnie*, No. 8, pp. 731-747, with Tables and Illustrations Paris, May 1922

The increasing demand that has arisen during the last twenty years for the meat of young lambs (*agneaux gris*), ready for the butcher at the age of 5 to 8 months has induced breeders to substitute for pure-bred animals, early maturing hybrids ready for the market when scarcely 5 months old, the product of an industrial cross between a Southdown ram and a Limousin goat. Only a first generation cross is made, the hybrids never being mated.

These animals are chosen as parents because large numbers of Limousin

SHEEP

or Berichon goats can easily be obtained in the region south of the Loire, while the Southdown ram is noted for its prepotency and transmits to its progeny the characters of early maturity, good conformation and excellent meat production. The characters of the parents are inherited in such a manner that the hybrids can be easily distinguished and identified. They always have the mouse-coloured head and legs peculiar to the Southdown, and although the extent of the pigmentation varies greatly in different cases, it is regarded as a dominant.

The Southdown limousin cross is very common but the technique involved still remains a matter for discussion. For instance some breeders recommend that the rams should be left entire, while others affirm that castration is necessary.

Another question in dispute is the age at which the hybrids should be sold, some experts being in favour of selling while very young while others advise keeping the animals till they reached a certain age, when they can command higher prices as the meat is of better quality.

One of the authors being a member of the Organising Committee of the Vaulx-de-Cernay Stock Breeding Experiment Centre, proposed that comparative crossing experiments should be made in order to determine the technique to be adopted and to show the effects of castration.

Experiments were accordingly carried out upon the hybrid offspring of a herd of 96 Limousin goats that had all been served by the same Southdown ram, Knight No 583. This ram was quite pure-bred, as was proved by the measurements taken by the author.

The goats were also pure-bred, for although they did not show the homogeneity characteristic of animals that have been selected by the same breeder and repeatedly inbred, they came from a country where the herds are free from any admixture of foreign blood.

The hybrids of the  $F_1$  generation were born from January 15 to March 6, 1921. All the males born within 24 hours of one another were compared during their growth period and at the time they were slaughtered, one of them being kept as a control, while the others were castrated directly they were 15 days old. The number of animals thus compared was 29: 11 entire and 18 castrated individuals out of the 120 hybrids (63 males and 57 females) produced by the 96 goats. All the animals were weighed separately every fortnight. They were suckled by their dams for 3 months and then fed liberal and varied rations, as well as given free access to the pasture.

The castrated individuals were divided into two groups, the first consisting of 11 head (these were compared from their birth with the same number of entire animals), while the second was composed of seven individuals which were kept to make good the losses in the first lot. These were born and slaughtered on the same day as the hybrids of lot 1.

The average age for slaughtering the animals was 6 months. The castrated hybrids were found to weigh from 4 to 4.2 kg. less than the entire. Thus castration has an injurious effect upon animals sent to the butchers at the age of 6 months. This conclusion has also been confirmed by ob-

servations made on the dressing-yield, 2 kg. more meat being obtained on an average from entire hybrids than from those that had been castrated.

E. F.

982 — **Goat-Breeding Congress at Ruremonde (Dutch Limburg).** — CREPIN, J., in *Revue d'Histoire naturelle appliquée* (Part I), Vol. III, No. 2, pp. 56-62. Paris, February 1922,

GOATS

In August 1921, a Congress of Goat-Breeders was held at Ruremonde (Holland); it was attended by 200 official representatives of seven countries.

The author gives a brief account of the subjects discussed at the meetings. A summary of the most interesting and less generally known facts brought forward is contained in the following paragraphs.

1) **THE GENETIC IMPROVEMENT OF THE DUTCH GOAT.** — This was a much debated question. The many Alpine goats imported from Switzerland during the last thirty years have not given satisfactory results chiefly owing to the difficulty of acclimatisation. The members of the Congress advocated a return to the local breeds.

The author considers that the goat-breeders of the Netherlands are working in the wrong direction and will never improve their herds until they try to recognise the true characters of the different breeds, as well as the peculiarities of each race, and cease basing their selection of individuals upon the absence of horns and lack of hair pigmentation, two characters that are not only very variable, but also mark degeneracy.

The German members of the Congress made some very interesting observations. Dr. DETTWEILER of Rostock agrees with the author that the qualities of a breed of goats do not depend upon coat colour and want of horns. He does not admit that the goat is so sensitive to climatic conditions as to be unable to thrive except in its original mountains, for, though from the form of its feet and its love of steep slopes it is clearly a mountain animal, the maximum returns are obtained from stall-fed herds.

2) **THE TREATMENT OF MILCH GOATS.** — TAPP (stock-breeding Inspector) of Münster, has discovered from a study of the milk yield of goats at all seasons, that the heat period under natural conditions occurs in the autumn, so that the young are born at a time when there is plenty of fresh, tender mountain grass. He advises that: a) goats should be allowed to kid every two years; b) they should be milked dry up to the time of kidding; c) such an arrangement of the date of service as will allow that the last females served may be still in milk when those first mated are running dry to prepare for the next lactation. It is clear that these measures are only applicable to a breed with a high milk yield such as the pure-bred goats native to the Alps.

**GOATS' MILK AS A FOOD FOR INVALIDS, ETC.** — Dr. POL DEMADE of Brussels has studied the effect of goats' milk in the nourishment of invalids and found that its use reduces the cases of infant gastro-enteritis by 50%. He considers this milk to be an excellent article for adolescent girls suffering from chlorosis or anaemia, as well as for tuberculous patients, although it can have no special power of destroying the Koch bacillus.

E. F.

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983 - Gloucestershire Old Spot Pigs. — SPENCER, S., in *The Journal of the Ministry of Agriculture*, Vol. XXVIII, No. 12, pp. 1105-1109, figs. 2. London, March 1922.

The standard for a typical Gloucestershire Old Spot pig is as follows: head, medium length and wide between the ears, nose slightly dished, ears rather long and drooping; chest wide and deep; shoulders well developed, but not projecting, in line with ribs; back long and level; loin very broad; sides very deep and presenting straight bottom line; belly and flank full and thick; quarters, long, wide and not drooping; tail set high, of moderate size, yet fairly strong and carrying long brush; hams large, not flat, and well filled to the hocks; legs, short, straight and strong. The skin, light or dark, must not show coloured splotches otherwise than beneath the spots of the coat which should be full and fairly thick, hair long and silky, but not curly, with an absence of mane bristles. Colour, white spots on black ground, or black spots on white ground. Such spots should be of medium size.

Bad points: narrow, head face and nose dished; ears thick, coarse or elevated; coat, coarse or curly; colour, slate or sandy; skewbald or saddle-back markings; wrinkles are also a highly objectionable feature.

The boars of the Gloucestershire Old Spots breed are very persistent in impressing their peculiar markings on their progeny, even from sows of other breeds and colour. This appears to prove that the breed is actually original and not the result of chance or of crossing two or more breeds within recent times.

Although nothing is known with certainty as to the origin and cause of the markings in this or in any other spotted breed, the causes of the present form, size and quality of the Gloucestershire Old Spots appear to be much more easily discovered and to consist essentially in the requirements of the pig-breeders and consumers. The animals are much in demand in the County of Gloucestershire on account of: a) the upland situation of many of the farms and the consequent need of a pig of robust nature, b) the large milk production, especially in the valleys, necessitating a considerable number of strong healthy pigs for the consumption of the skin milk, butter milk and whey: c) the need of bacon for the summer supply of animal food for the numerous farmers and their large families.

The Gloucestershire Old Spots pig, which is a hardy prolific and quick-growing animal most suitable for the manufacture of large, heavy, thick sides of bacon, fulfils all these requirements admirably.

In view of the great difficulty in retaining certain points in other breeds, it may be asked why these qualities seem likely to persist under changed conditions. One possible answer is that these particular characters are more or less inherent in the Gloucester Old Spots breed, whereas the special points which it is desired to retain in other breeds are fancy characters, to a certain extent the result of chance and therefore not natural to the animal and of little or no practical value.

Another proof of the many good qualities of this Gloucestershire pig is furnished by the phenomenal success of the Society established some 8 or 9 years ago. The first volume of the Herdbook, published in 1915, con-

tained the pedigrees of 39 boars and 242 sows, giving a total of 256, whereas the seventh volume published in 1921, contained the entries of 1407 boars and 5382 sows or a total of 6,789.

E. F.

984 — **The Presence and Significance of numerous Bacterial Spores in the Body of the Silkworm Moth.** — LOMBARDI, L., in *Bollettino della R. Stazione Sperimentale di Sericoltura*, Year I. No. 3, pp. 87-96. Ascoli Piceno, July 1, 1922.

SERICULTURE

The presence in the silkworm moth of any microorganism other than the pathogenetic agent of pebrine has hitherto been regarded as a matter of no practical importance. This opinion has now been somewhat modified by the researches of the author who at the request of a firm supplying silkworm eggs examined the bodies of certain affected moths in order to determine whether the eggs laid by them could safely be used. The bodies of the insects were covered with innumerable pustules, the trunk became shrunken and the legs and wings dropped off, so that the diseased insects could be recognised in the compartments.

The author began by determining whether the pustules which under the highest powers of the microscope had the appearance of crystalline dust and were resistant to chemical agents, consisted of accumulations of vibriion spores whose development was promoted by moisture.

Silkworms fed on leaves dusted over with spores did not contract the infection and their cocoon yield was about the same as that of the control lot, though the control group produced longer-lived moths.

The author's researches show that the spore masses may arise in two ways; either the moth is infested by the microorganisms when it leaves the cocoon, or the bacteria find favourable conditions for exceptional development in the excessive dampness of the environment due to a lack of ventilation in the storage rooms.

If only a few diseased moths are found in one part of the store-house, the question may be regarded as of little importance; should however the percentage of affected insects be high it is a bad sign for the quality of the eggs, except in the case of small and very active breeding establishments.

F. D.

985 — **The Value of the Fifth Quarter in the Meat Trade.** — DECHAMBRE, P. and DEGORS, E., in *Revue de Zootechnie*, No. 7, pp. 634-645. Paris April 15, 1922

VARIOUS

The weight of a slaughtered animal is calculated from that of the 4 quarters of meat. Not only the net meat, but all the other parts are of value. The head, viscera, glands, fat and hide make up what is known as the fifth quarter, and it is an old tradition in the meat trade that the yield of this fifth quarter considerably diminishes the purchase price of the pound of meat. Since the War, in the estimates of butchers anxious to fix their prices, this reduction has varied round about 50 centimes per pound of net meat. The author thought it would be of some importance to discover the causes of these variations. These have been determined sufficiently accurately from weighings made of all parts of the animals slaughtered at the Perray abattoir connected with the Vaulx-de-Cernay Stock-Breeding Centre. In order to fix prices, it was necessary as far as pos-

sible to know the weight of the different kinds of offal. For this purpose, the author collected the results of the weighings of 82 cattle of different breeds and ages and of both sexes, compared the figures thus obtained, and struck averages to which could be applied the prices now asked. The figures obtained at the Stock-Breeding Centre were tested by a certain number of results published by CORNEVIN, LAWES and GILBERT, and WOLFF. The weight of the offal is expressed as a percentage of the live-weight of the animal at the time it is killed. The author examined in turn the feet, tongue, cheeks, brain, heart, liver, viscera, hide and suet. The results are given in the following list.

feet . . . .	1	%	price of kilogramme	1	fr.
tongue. . . .	0.4	$\frac{0}{10}$	» » »	9.50	»
brain . . . .	1	pound	» » »	8.00	»
cheeks . . . .	1.5	$\frac{0}{10}$	» » »	3.00	»
heart . . . .	0.4	$\frac{0}{10}$	» » »	5.00	»
liver. . . . .	1.2	$\frac{0}{10}$	» » »	5.00	»
tripe. . . . .	3.5	$\frac{0}{10}$	» » »	2.50	»
viscera. . . .	1	$\frac{0}{10}$	» » »	—	»
hide . . . . .	7.5	$\frac{0}{10}$	» » »	2.00	»
suet. . . . .	5.4	$\frac{0}{10}$	» » »	1.30	»

After finding the weight of each of these kinds of offal, it was only necessary to know the retail prices asked in each district in order to ascertain the value of the fifth quarter. If we take the yield as 50 %, the total amount paid for the offal is to be distributed over 1000 lbs of meat. Then 0.50 represents the reduction in one pound of meat due to the fifth quarter. This figure is higher if the yield of the animal is below 50 % and lower if it exceeds 50 %. From the results obtained it may be calculated that the money value of the fifth quarter regularly reduces by one franc the price of the kilogramme of net meat bought standing.

F. S.

## FARM ENGINEERING.

### AGRICULTURAL MACHINERY

986 - **A New Plough-Share.** — CLAROU, CH, in *Revue Agricole de l'Afrique du Nord*, Year 20, No. 155, pp. 463-464, fig. 1. Algiers July 21, 1922.

In order to insure the plough-share penetrating deeply, especially into dry soils, DE CONINCK has hit upon the plan of providing it with several recurved points distributed along its width, in place of the usual single awl-shaped point.

Three points are affixed to this share, one at either end and the third in the middle and make the share cut the ground better and assure the horizontal section of the furrow, afterwards turned by the mould-board. The portion of the share between the points is not sharpened.

The author has tried mounting this share on a double two-way plough by attaching to the second body an ordinary share. The points cause the plough to cut more deeply into the soil with the expenditure of



less traction force. The DE CONINCK share can be mounted on any plough-body, but is especially suitable for heavy types such as the double two-way plough.

F. S.

## RURAL ECONOMY

987 — **The Production of large and of small Farms in Sweden.** — HÖIJER, R., in *Recherches de la production des grandes et petites fermes en Suède*, pp. 1-16. Stockholm, 1919 (1).

The author divides the agricultural farms into 4 classes :

- 1) farms with a maximum of 2 hectares under cultivation
- 2) " " 2 to 10 hectares under cultivation
- 3) " " 10 to 50 " " "
- 4) " " over 55 " " "

He emphasises the great difficulty of determining the effect of a single factor — in this case, the size of the farm — upon the yield of the land. In this work, he confines his attention to the quantitative production of the land, and deals with certain districts of Sweden that are similar in character.

The districts are treated separately and are as follows: 1) the plain in the Government of Malmöhus; 2) the plain of Kristianstad; 3) the uplands of south Sweden; 4) the plain of Vestergötland; 5) the plain of Östergötland; 6) the valley of Lake Mälär. In the case of each of these districts, the author studies its importance from the agricultural standpoint, the climate, length of the growing season, annual rainfall, nature of the soil, percentage of the surface under cultivation, crops grown, state of the drainage, facilities for communication and percentage of the population engaged in agriculture. He also gives three graphic Tables showing, for each class of farm, the standard of cultivation, the crop yield and the condition of stock-breeding.

The reader's attention is drawn to the fact that as regards crop returns, the large farms are far superior to the smaller, although the cultivation intensity index of the large farms is lower. This is due to the fact that the figures taken do not represent the total intensity, but only the labour intensity. The latter is always higher in small farms, whereas the cultivation intensity is greater in large farms. If the total figures were available, there would probably be a change in favour of the large farms, and the intensity figures would correspond to the crop yield.

*Conclusions.* — The best size of farm depends upon the district; where agriculture is well developed large farms are more satisfactory, and from the point of view of the utilisation of the crops and their nutritive value, they are superior to small farms, but large farms are always more

(1) From a report made by A. LEKANDER and laid before the Agricultural Academy of Sweden.

easily affected than medium, or small, holdings by changes in the general economic condition of the country.

On the other hand, in districts where the natural advantages are not great, small and average farms can always compete successfully with large farms, although their prosperity is only relative, for they are unable to adopt the methods of cultivation, or profit by the progress of technique to the same extent as similar holdings in more favoured regions, where larger farms are paramount.

F. S.

## AGRICULTURAL INDUSTRIES

### OENOLOGY

988 — **Composition of Bulgarian Grapes, Must and Wines.** — DIMITROFF, CHR. in *Описание на земеделските изпитателски институти в България за природонаучни и стопански изследвания из областта на земеделието.* (*Review of the Agricultural Research Institutes in Bulgaria*), Year II, Nos. 3-4, pp. 137-163 (French, summary pp. 164-166 Sofia, 1922.

The author refers to the importance of the vine-growing industry in Bulgaria, the spread of phylloxera, the necessity for reconstructing the vineyards in Bulgaria with American vines, the physiological processes involved in the ripening of grapes and the chemical changes accompanying it. Four tables are given at the end of the paper setting out the results of the analyses of : 1) some varieties of grapes gathered in 1911, in the neighbourhood of Pleven (school of Viticulture and Station of Viticulture and oenology ; 2) 55 different samples of the same vintage sent by vine-growers ; 3) 110 samples of musts. They also contain the results of the complete analyses of 27 white and 63 red wines from the various provinces of Bulgaria :

The general averages, minima, and maxima are as follows.

Table I : berries : 91.7 — 84.9 — 96.8 % ; stalks : 6.9 — 3.2 — 15.1 % ; must : 72.9 — 55.9 — 51.2 % ; pomace : 20.9 — 13.4 — 29.5 ; grape-skin : 18.6 — 10.2 — 26.9 % ; pips : 2.3 — 1.1 — 4.8 % ; sugar in must : 13.4 — 10.6 — 15.6 % ; total acidity : 0.45 — 0.30 — 0.70 % ; dry extracts : 5.15 — 3.81 — 7.98 %.

Table II : must : 77.4 — 65.5 — 86.5 % ; pomace : 22.8 — 14.9 — 31.5 % ; grape-skin : 20.3 — 11.3 — 32.5 % ; pips : 2.5 — 1.2 — 5.9 % ; sugar : 14.6 — 11.9 — 18.0 % ; total acidity : 0.49 — 0.32 — 0.80 %.

The general averages of Table III are : sugar 16.79 % ; density : 1.0791 ; acidity % (expressed as tartaric acid) : 0.7980.

The general averages of Table IV are : for the white wines : density : 0.9903 ; alcohol : 10.00 % ; extract : 1.9029 ; total acidity : 0.5818 ; volatile acidity : 0.1662 ; fixed acidity : 0.3714 ; tannin : 0.0084 ; sugar : 0.4719 ; glycerine : 0.6042 ; ash : 0.1691 ; phosphates ( $P_2O_5$ ) : 0.0181 ; sulphates ( $SO_3$ ) : 0.0147 ; potassium sulphate : 0.0319 ; alkalinity of ash (deci-normal solution of sodium hydrates) : 13.75 ; for red wines respectively : 0.9942 — 8.14 — 2.1750 — 0.7610 — 0.1665 — 0.5529 — 0.0474 ; minimum quantities : 0.5006 — 0.2191 — 0.0210 — 0.0281 — 0.0612 — 15.03.

F. D.

989 - **Figs as Raw Material for Alcohol Manufacture and as a Stock Feed.** — BENAVENT, J. in *Agr. culture*, Year VI, No. 3, pp. 354-356. Barcelona, July 5, 1922.

One of the products used in the manufacture of alcohol is the fruit of the fig-tree, *Ficus carica*.

A single tree bears a considerable number of figs ; in the province of Murcia, over 150 kg. of dried figs are obtained from each tree. BAYER, states that on soils of average quality 50 kg. of dried fruit are produced per tree and 4500 kg. per hectare.

The actual alcohol yield of ripe figs is almost equal to that of plums : 15 to 20 kg. of 90° alcohol or 30 to 33 litres of 54° alcohol is given by 100 kg. of dried figs. One hectare of fig trees produces 800 to 900 litres of 90° alcohol.

For obtaining alcohol either fresh or dried fruit can be used. In the first case, the figs are gathered when ripe and crushed in cylindrical presses ; tepid water is then added to the mass to be fermented, although extraction by maceration is preferable. Great care should be taken not to allow the density of the must to fall below 5° B. The vat with the fermenting mixture is then covered and a constant temperature of 20° C. maintained. When the fermentation process is complete, the fermented liquid is drawn off and the vat left open for 10 to 12 days, in order to obtain the best and most homogeneous product.

When dried figs are used, they are left to soak in water having a temperature of 50 to 60° C. After two days, they are subjected to the treatment described above.

*Nutritive value of figs before fermentation.* — According to the analyses made by RAVENTOS (Barcelona), figs contain : 4.3 % protein ; 0.3 % fat ; 71.2 % sugars ; 3047 calories, whereas the analysis of wheat gives : 10.7 % protein ; 2.1 % fat ; 74.7 % of sugars and 3519 calories. These figures explain the value of this food for the rapid and effective fattening of pigs.

*Nutritive value of figs after fermentation.* — An analysis made of samples from Majorca at the Laboratory of the Catalanian Service of Agriculture shows that the fermentation residuum contains : 85.71 % moisture at a temperature of 160° C ; 1.08 ash ; 1.75 % protein substances ; 0.27 % fats ; 3.37 % crude fibre, 7.82 % nitrogen-free extracts. These results show that figs after fermentation make a good stock feed ; they are very suitable for fattening cattle, though should not be fed to dairy cows.

E. C.

990 - **Sulphite Alcohol.** — DU BOISTESSELIN, H (Professeur à l'Institut Chimique de Rouen) in *Le Moniteur Scientifique Quesneville*, Series V, Vol. 12, No. 962, pp. 97-105. Paris, May 1922.

In the calcium bisulphite process adopted in the manufacture of cellulose, the decorticated wood, after being reduced to fragments, is put into an autoclave and subjected to the action of steam. A lye is added to the calcium sulphite and the temperature maintained at from 125-140° C for 15 or 20 hours. As the digestion proceeds, the lye becomes dark as a result of the organic substances, (amongst which are certain sugars,

produced in the alcohol by fermentation. This alcohol is called sulphite spirit to indicate its origin.

Over 2 million tons of cellulose are now made by the bisulphite process and therefore about 1 million hectolitres of alcohol, reckoned as absolute alcohol, could be obtained.

WALLIN and EKSTRÖM, two Scandinavian engineers took out almost at the same time a patent for the industrial manufacture of alcohol by the sulphite process which is in more general use than any other. Sweden became the home of this new industry which developed rapidly: between 1909 and 1920, the output of sulphite alcohol rose from 19 000 litres to 20 000 000 litres. At the present time, there are 22 factories in Sweden and 2 more in Norway. During the War, the sulphite alcohol process was prescribed by the Government in Germany. The United States and Canada are considering its introduction. In France, nothing has so far been done, although 60 000 tons of cellulose are manufactured which might correspond to the output of 24 000 hectolitres of 100° alcohol; 200 000 tons of cellulose pulp are also imported. This pulp, as has been pointed out by BIELET, could well be made in the country from imported wood, especially if alcohol were manufactured as a by-product.

The amount of alcohol thus obtained would be small as compared with the quantity required, being barely 4 % of the total out-put in France, but at the same time of a certain value.

The author examines the technical side of the problem. He shows that the sugars of the residual lyes left after the manufacture of cellulose are only derived to a small extent from the cellulose; they come mostly from the gums, and vary according to the quality of the wood, glyucose and mannose being obtained from the wood of gymnosperms, and glyucose and xylose from the wood of angiosperms. The maximum amount is obtained by the digestion of the wood for 15 hours at 128-138° C under pressure of about 4 atmospheres. He describes the various industrial methods which come under the two following heads, the Swedish process which has already been tested, and the American which is still on trial. In the first, the sulphurous anhydride that always accompanies the sulphite and checks alcoholic fermentation is neutralised by spent lime, which is afterwards removed by decantation; this is the WALLIN and EKSTRÖM method. A modification introduced by LANDMARK consists in the addition of whey which obviates the necessity of accustoming the fermentation micro-organisms to the new medium. In the second method, the sulphurous anhydride is removed by boiling and by a vacuum (MACKEE), or else by a current of air (MARCHAND). It should be noted that boiling alone is not sufficient, for while it drives off the sulphurous acid present, it also causes a partial decomposition of the sulphite.

The alcohol produced has been chemically examined with varying results; according to MORVER's analysis in 1912, it would appear to be purer than the alcohol made from cereals, but VON SCHEEL considered these data inaccurate, and gives the results of a very careful analysis, showing that this alcohol contains a perceptible amount of impurities, for

instance 3.4 % of methyl alcohol. The methods of production have since been improved, and the author is now in a position to give comparative analyses of potato alcohol, cereal alcohol and sulphite alcohol which show the remarkable superiority of the sulphite alcohol and it can now be used in the preparation of alcoholic beverages.

For industrial production large plants capable of turning out 30 000 tons of cellulose paste are to be recommended, but small plants such as exist in France, having an output of from 10 000 to 12 000 tons are also very profitable.

L. V.

991 - **North African Barley and Malting.** — See No. 952 of this *Review*

VARIOUS  
INDUSTRIES

992 - **Milling and Baking Value of Saskatchewan Wheats.** — See No. 948 of this *Review*.

993 - **Desiccation of Fruits.** — CRUESS, V W and CHRISTIE, A W (College of Agriculture, Agricultural Experiment Station, Berkeley, California) in *University of California Publications, Bulletin* No. 330, pp. 47-77, 2 figs. Berkeley, September 1921

The authors were induced to make these experiments by the great development of fruit-growing in California, for though the dried fruit industry is already very flourishing, it will have to be further increased in order to be able to deal with all the produce of the orchards and fruit-gardens, so many new trees having been recently planted.

When the industry was first started some thirty years ago, the fruit was dried by artificial heat; later it was dried in the sun. The fruit thus prepared acquired a great reputation so that it would be difficult to substitute the artificially dried products, although new markets could easily be found where they would have a ready sale.

By desiccated fruit, the authors mean fruit dried by artificial means with as little alteration as possible in its physical and organoleptic properties. For this purpose are employed: currents of air, creosote and slightly raised temperatures. When so treated, the fruit has the same qualities as sun-dried fruit, sometimes indeed it is even superior, as in the case of grapes.

The advantages of desiccation over sun-drying are: greater rapidity and ease in the operation which can be carried out even in over-cast or rainy weather, whereas fruit dried in the air easily spoils. The artificial product is sound and its qualities — or defects — are quickly recognised.

By means of a grant from the State of California and the assistance of various firms, the authors have been able to make numerous experiments on a large scale. They use a machine, the air-blast tunnel dehydrator, which supplies a current of air and should maintain a moderate temperature. The machine is however rather small, which increased the unit expenses by giving too much draught (150 to 300 m. per second) and an excessive raising of the temperature to about 99° C at the beginning and about 77° C at the end. Even when the machine is well loaded,

*Process recommended for the Desiccation of fruit*

Kind or fruit	Weighting per c m	Hours of sulphuring	Max. Temp at end of process	Moisture required at the end of the process	Duration with the counter current system	Notes
Pears	7.5	1 2	74° C	5-10 %	8	Peeled, cut in slices or squares
Apricots	7.5	1	71	10	12	Halved, unpeeled
Apricots	7.5	1 1/2	71	10	8	Sliced
Bananas	3.5-7.5	1 1/2	74	5-10	12-18	Peeled, split, lengthwise
Cherries						
Black Tartarin	7.5-11	0	76.7	10-25	8-12	Treated with the lye
Royal Anne	7.5-11	1 1/2	76.7	10-25	8-12	" " "
Flgs	7.5-11	1	71	5	10	Split down one side and opened
Grapes						
Muscats	13-14.5	0	71	5	24	Treated with the lye
Pippless	13-14.5	1	71	5	16	" " "
Must	13-14.5	1	71	5	20	" " "
Loganberry	5.5-7.5	0	71	10-25	10-15	Untreated
Peaches	11	1	65.6	10-20	24	Unpeeled
Peaches	11	1	65.6	10-20	16	Chemically peeled
Pears	11	24	65.6	20	28	Halved, unpeeled
Pears	7.5	1 1/2	65.6	10-20	6	Peeled and cut in slices
Pears	7.5	1	65.6	10	16	Peeled whole
Plums						
French	9-14.5	0	74	5-10	24	Chemically peeled
Imperial	11-14.5	0	74	10-20	30-36	Treated slightly with lye
Raspberries	5.5-7.5	0	76.7	10-25	8-12	Not treated
Strawberries	5.5-7.5	1 1/2	71	10-25	24	Stalks removed

the fruit dries rapidly, but if the temperature is too high, its quality is much impaired. Different kinds of fruit can stand different maximum temperatures.

In certain cases, the authors peeled the fruits chemically by plunging them into boiling lye, then rinsing them in cold water and rubbing if necessary. Peaches were put into 5 % lye for 30 seconds; for pears a 10 % solution was required, the fruit being left in the solution for from 20 to 40 minutes according to the toughness of their skins.

Fruits thus peeled needed a less prolonged sulphur treatment, dried more rapidly and had a more attractive appearance, but they stained the wooden boards on which they were placed.

Frequently the authors found it advisable to alter the duration of the sulphuring according to the conditions of the experiment, for the sulphurous acid liberated corroded the wire-netting, and discoloured the fruit and also gave it a disagreeable flavour. These bad effects can however be prevented if the fruit is placed on planks of wood.

The principal results of the authors' experiments are given in the appended Table. They are still engaged in further experiments of which they hope soon to publish an account.

L. V.

994 - **The Amino-Acids in Cow's Milk.** — HIIJIKATA, I., in *The Journal of Biological Chemistry*, Vol. II, No. 1, pp. 165-170. Baltimore, 1922

DAIRYING

It is a well-known fact that a small part of the total nitrogen content of cow's milk is not formed of protein. So far only urea, uric acid, hypoxanthine, guanine, adenine etc. had been identified as constituting this fraction; the author has now added to the list the following amino-acids: lysine, arginine and histidine. Probably the mono-amine acids also enter into the physiological composition of cow's milk, but the author considers that further researches are necessary before this can be proved.

E. F.

995 - **Composition of Imitation "Pecorino Romano" Cheese.** — FASCETTI, G. in *Annali dell'Istituto sperimentale di Caseificio in Lodi*, Part 3, pp. 112-114. Lodi, 1922

The large exportation of "pecorino romano" cheese, which is made in Latium from ewes' milk, first led to the manufacture of an imitation product in Sardinia and South Italy from sheeps' milk and afterwards in North Italy from cows' milk, where no ewes' milk is available. In order to give this spurious cheese the characteristic commercial and organoleptic properties of true "pecorino", it is not enough to adopt the same methods in its preparation.

If however lambs' rennet diluted in sheeps' milk serum is used (serum is sent from the Campagna Romana for the purpose), a product is obtained which, after ripening for 6 months, acquires a slight smell of true "pecorino" which increases with further ripening. This imitation "pecorino" has also qualities of its own as the curd has a more delicate flav-

our; it is a distinct type and has its special patrons who prefer it to the genuine "pecorino" with its more pungent taste.

It is not difficult to distinguish real "pecorino" from the imitation by means of its smell; the author has however made a careful chemical study of the false "pecorino" to serve as a basis for its identification.

The chemical analysis of spurious "pecorino" gave the following percentages: water 31.50 — fats 26.60 — nitrogenous substances 30.51 — ash 11.39. The analysis of the degree of fermentation gives: total nitrogen 5.010 % — soluble nitrogen 1.275 % — albuminose nitrogen 0.225 % — peptone nitrogen 0.289 % — amide nitrogen 0.306 % — ammoniacal nitrogen 0.017 %. The Roman "pecorino" differs from its imitations in having a high proportion of fats and ammonia. According to SARTORI's analysis, its dry matter contains from 0.117 to 0.157 % of ammonia and between 41 and 45 % of fats (1).

F. D.

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(1) See: G. SARTORI, *Casellificio*, Vol. I, *Chimica*, pp. 254. 1902 (*Author's note*)



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## PLANT DISEASES

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### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

- 996 - **Researches on "Incappucciamento", a Disease of Red Clover** (1). — MANZONI, L., in *Le Stazioni sperimentali agrarie italiane*, Vol. LV, Parts 4-6, pp. 136-144, 2 pl. Modena, 1922

In the spring of 1920, some plants in a plot of *Tritolium pratense* on the estate belonging to the "Scuola di Viticoltura e d'Enologia" at Conegliano (Prov. of Treviso), were attacked by a typical form of "incappucciamento".

The root system of the plants was free from any signs of old or more recent attack by insects or other animals.

In every case however the wood vessels in the neighbourhood of the root-collar, or those at some distance below it, were obstructed by brown or sometimes black masses, some of which instead of being homogeneous, clear and almost transparent, were dense, opaque and finely granular, recalling a zoogloea. On examining these masses more carefully they were seen to be composed of hitherto unidentified bacteria, usually elongated, but sometimes elliptical and united in pairs. These micro-organisms were 1 to 2  $\mu$  long, and 0.5  $\mu$  or a little more in width. They were isolated, cultivated and inoculated into young, healthy plants.

It is probable that the bacteria find their way into the tissues of the host plant through very small wounds that afterwards heal over completely.

The root bacteriosis observed in clover plants suffering from "incappucciamento" is certainly not the cause of the disease; in any case it has never been shown to be responsible for it; on the other hand it cannot be definitely stated whether or not the form of bacterium isolated is the specific agent of the affection of the radicle system. G. T.

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

- 997 - **A Contribution to the Mycological Flora of Southern Italy.** — PARISI, R., in *Bollettino dell'Orto botanico della R. Università di Napoli*, Vol. VII, pp. 37-66 Naples, 1922.

This is a list of 205 species belonging to the mycological flora of south Italy. It has been compiled from the valuable material growing in the

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(1) See R. Feb. 1914, No. 181; R. Dec. 1914, No. 1181; R. Aug. 1915, No. 858. (Ed.)

Naples Botanical Garden, or collected by the author at Naples and in the Province of Caserta.

Among the species mentioned — which include many Micromycetes parasitic on cultivated or other useful plants — two are described as being new to science (*Didymosphaeria Euphorbiae* and *Diplodia ulcina*), and seventy-one as having been already recorded in south Italy. G. T.

998 - *Bacterium Tumefaciens* and *Bact. Beticola* and the Soil. — See No 915 of this Review

PARASITIC  
DISEASES  
OF VARIOUS  
PLANTS

999 - *Claviceps purpurea* on Oats in Algeria. — DUCEILIER, L., in *Bulletin de la Société d'Histoire Naturelle de l'Algérie du Nord*, Vol XIII, No 4, pp 98-99 Algiers, 1922

*Claviceps purpurea* occurs in Algeria on many of the wild Gramineae (*Ampelodesmos*, *Festuca*, *Lolium* etc.), but the only cultivated species of the order so far attacked appears to be the oat

Since 1886, in which year ergot was especially noticed on oats coming from the valley of the Mekerra, the fungus has been seen in different regions of Algeria. The author has found it both in samples of oats sent to the Maison-Carrée Seed Station, as well as on standing oats in the neighbourhood of Bel-Abbès (1907-1908), in the Sahel of Algiers (1907-1908), in the valley of the Chéiff (1920-1921) and in the Department of Constantine (1908-1920-1921)

In Algeria, *C. purpurea* infests several species of oat, but is most frequently met with on the red African oat, a variety of *A. algeriensis* Trab., which is the kind most commonly grown

Ergot is also found on the Algerian black oat (another variety of *A. algeriensis*), in the Departments of Constantine and Oran, in Oran the fungus has been seen on the grey and the white oat (varieties of *A. sativa* L.) while at Bel-Abbès, it is reported as occurring on *A. fatua* L. var *glabrescens* Coss

The ergot of oats can be used in the same manner as rye ergot (1)  
G. T.

1000 - **Further Observations on Tomato Rot** (2). — CIFERRI, R., in *Le Stazioni sperimentali agrarie italiane*, Vol LV, Parts 4-6, pp 145-162. Modena, 1922

As a result of further study of the disease first noticed in 1921 near Alba (Province of Cuneo), and described under the name of tomato rot, the author considers that the Spherioides, *Phoma Ferrarisii* Ciferri, produces a typical form of dry rot in the green fruits of the tomato which entirely empties them of their contents.

If *Bacillus mesentericus* subsequently attacks the tomatoes, the disease assumes quite a different form called by the author "wet rot" (carie humide) to distinguish it from the first type.

The Mucedinea found on tomatoes already attacked by the Spherioi-

(1) See R May-June 1922, No 550 (Ed)

(2) See R Oct 1921, No 1065

dea and at first called by the author *Ramularia* sp. has now been specifically identified.

It is here described by him under the name of *Ram. Ferrarisii* n. sp. The data at his disposal do not allow him to state with certainty that there is any metagenetic relation between the Mucedinea and *Ph. Ferrarisii* as was previously suggested.

In order to check the spread of the disease, it is advisable to destroy all the infected fruits.

G. T.

1001 - *Ganoderma sessile*, a Polyporea injurious to Fruit Trees and Forest Trees, in Argentina. — GIROLA, C. D., in *Boletín del Ministerio de Agricultura de la Nación*, 2 pp., 2 pl. Buenos-Ayres, 1922.

Although *Ganoderma sessile* Murrill is by no means a very common fungus in Argentina, it attacks many fruit and forest trees and often causes a considerable amount of damage. The infection spreads either by means of the under ground mycelium passing from the diseased to the healthy roots, or else is conveyed by spores falling on wounds or lesions in the superficial roots or lower portion of the trunk.

In a single plantation this Polyporea has been noted on *Prunus Armeniaca*, *P. domestica*, *Pirus communis*, *Ficus Carica*, *Punica Granatum*, *Robinia Pseudacacia*, *Gourliea decorticans*, *Casuarina stricta*, *Eucalyptus Globulus*, *Tipuana Tipa*, etc.

As regards the control measures recommended, care must be taken not to introduce into soil that is free from the fungus any infected plants or roots, and to avoid contaminating the ground with soil, manure or débris containing the mycelium. All plants suspected of disease must be isolated, and the roots of badly infested trees should be dug up and burnt; the fructifications of the fungus must be carefully collected and burnt. The infected parts of the host-plant ought to be cut off, and pure tar or tar mixed with resin applied to the surface of the wound thus produced. It is also useful to disinfect with 5 % formalin, sulphuric acid etc. Great efforts should be made to avoid causing wounds or lesions in the superficial roots and near the root collar of the tree. All pruning implements that have been in contact with the diseased trunks, branches or roots must be at once thoroughly disinfected before they are used for cutting the sound portions of the tree.

When making new plantations, no dung should be applied and all lesion or wounding of the young trees scrupulously avoided. If there is any suspicion of infection, it is necessary to treat the roots with a 1 % solution of corrosive sublimate, or a 5 % formalin solution. All the props used for young trees should be disinfected by scorching or by immersion in a solution of copper sulphate, or a 5 % solution of formalin. It is also recommended that the end of the stake should be dipped in hot tar before it is driven into the ground. Where the trees have died as a result of the fungus attack, they must not be replaced for three years.

Water should not be allowed to collect near the root-collar of the trees, for moisture encourages the growth and propagation of the parasite.  
G. T.

1002 — *Microstroma Tonellianum*, a Mucedinea Parasite on the Plum Tree in the Marche. — CIPERRI, R., in *Rivista di Patologia vegetale*, Year XII, Nos. 5-6, pp. 59-64. Pavie, August 1, 1922.

The author describes in this paper an affection of the leaves of the plum tree (Luther Burbank var.) which was observed at Macerata and is characterised by the occurrence on the upper surface of the lamina of irregular whitish spots, corresponding to very small, whitish, waxy, scattered, or confluent dots that make their appearance on the lower surface.

Microscopic examination showed this affection to be due to the Mucedinea, *Microstroma Tonellianum* Ferr, which was described as a very rare parasite of the leaves of *Prunus domestica* when found for the first time at Valsalice (Turin) in July 1912.

All the infected leaves should be collected and burnt and spraying with Bordeaux mixture is the best prophylactic measure to adopt. G. T.

## WEEDS AND PARASITIC FLOWERING PLANTS

1003 — The Spread of *Panicum Phyllogon* and *P. erectum* in the Italian Rice Fields (1). — NOVELLI, N., in *Cronaca Agricola*, Year XXVII, No. 16, p. 4. Turin, August 31, 1922

Some years ago, owing to the use of impure seed of foreign origin, *Panicum phyllogon* and *P. erectum* were accidentally introduced into certain Italian rice fields that had been successfully freed from these pests by careful hoeing and weeding. Both these weeds, but especially *P. erectum*, having once established themselves, continued to spread in many of the rice-growing districts and seem to be still gaining ground.

In the author's opinion the only really effective means of controlling these weeds is to transplant the rice in the most infested plots. If this is not done, the greatest care must be taken to clean the ground, and hoeing should be carried out very late in badly attacked fields. The grain used for sowing must be free from all admixture of *Panicum* seed and the soil always worked to a considerable depth.  
G. T.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

### GENERAL

1004 — The Coccid *Icerya purchasi* reported in Spain. — GARCIA MERCET, R., in *Boletín de la Real Sociedad Española de Historia Natural*, Vol. XXII, Nos. 1-2, pp. 136-141, figs. 4. Madrid, 1922.

No breeding centre of the Coccid *Icerya purchasi* had been known to exist in Spain until recently, when a colony was found on a *Citrus* shrub in the garden of the " Instituto general y técnico " at Badajoz.

As however the parasite has been reported from Portugal ever since

(1) See R. Dec. 1912, No. 1688 and R. March 1919, No. 279. (Ed).

1896, it is most probable that other breeding centres are to be discovered on the Spanish-Portuguese frontier.

G. T.

1005 - Experiments in Controlling the Macrolepidopteron, *Operophtera (Chelmatobia) brumata*, in France (1). — PAILLOT, A., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VIII, No. 27, pp. 745-748. Paris 1922.

MEANS  
OF  
CONTROL

It was found at Charly, in 1921, on examining the apricot trees of the 1920 experiment field that where the trunks had been protected by a band of viscous substances, many fewer adult individuals of *Operophtera (Chelmatobia) brumata* were present as compared with former years, and that the emergence period of the perfect insects was also much prolonged. Although the number of trunks treated was the same, there was a great difference in the number of insects caught each year. In 1920 and the two preceding years, many more adult males than females were taken, and as the sexes were captured in practically the same proportions in 1920 and 1921, it would seem probable that the males normally out-number the females. Although the males are provided with well developed wings, they too no less than the females, seem to reach the upper portions of the tree by way of the trunk.

The principal cause of the retarded emergence of the adult insects in 1919 was probably the peculiar meteorological conditions obtaining throughout the year, and especially in October, when the mean temperature was much higher than usual.

From observations made at Mouthiers in the Valley of the Loue, which is considerably colder than the Lyons district, it was found that the adult forms of *Op. brumata* emerge earliest when the average temperature is lowest. This fact must be taken into account in order that the most favourable moment for the application of the viscous bands may be chosen.

Comparative experiments have been made with Tanglefoot and other viscous mixture. One of them which is manufactured by C. W. COLLINS and CLIFFORD E. HOOD, of the Melrose Laboratory (United States) is very similar in composition to "Raupenleim", a substance widely used in Germany and Switzerland. Like Tanglefoot it can be applied directly to the bark of the trees and has the further merit of being very cheap. An attempt has been made at the Lyons Gas Works to compound a similar mixture with a basis of French products, as the process is well known and the raw material plentiful. The first results obtained were not satisfactory, but the author hopes that it will soon be possible to manufacture the mixture in France on a large scale.

G. T.

1006 - *Megastes pucialis*, a Microlepidopteron injurious to the Sweet Potato in the State of Bahia, Brazil. — BONDAR, G., in *Chacaras e Quintas*, Vol. XXV, No. 6, pp. 473-474, figs. 2. São Paulo, June 15, 1922.

INSECTS, ETC  
INJURIOUS  
TO VARIOUS  
CROPS

The Microlepidopteron, *Megastes pucialis* Saell. (fam. *Pyrilidae*) is one of the most formidable enemies of the sweet potato in the State of Bahia. The insect propagates throughout the year, but does most damage

(1) See also R. May 1921, No. 584. (Ed.)

during the winter from May to August. The larvae excavate large galleries in the stalks of the host plant, thus causing hypertrophy in the plant and also in the root system. When the larvae attack the tubers, the injury is still more serious.

The presence of the caterpillars is betrayed by little heaps of excrement that accumulate round the base of the plant and by the severe wilting or even sudden death of stems exposed to the rays of the sun.

The insect does most damage in June and August, the time at which planting is begun; more than half the sweet potatoes are attacked at a very early stage by the larvae which appear in large numbers, at this period, so that it is often necessary to replace the young plants two or three times.

The following methods of control are recommended: 1) The removal of all other *Convolvulaceae* that may be growing in the neighbourhood and serve as hosts to the Microlepidopteron passing thence to the sweet potato; 2) the planting of the sweet potato from January to April, so as to obtain strong vigorous plants by the time *Megastis pucialis* begins to make its appearance.

Owing to the habits of the caterpillar, insecticides are not to be advised. A visit should be paid to the field during the hours of sunshine and when any wilted plants or heaps of excrement are found, an attempt must be made to remove the parasite from the stem and destroy it.

G. T.

1907 - Notes on *Dinapate wrighti*, a Beetle living on the *Washingtonia filifera* Palm in California. — TOMPKINS DE CARNETT, R., in *Bulletin de la Société entomologique de France*, No 9, pp 119-121, 1 pl Paris, 1922

The Bostrichid, *Dinapate wrighti* Horn lives in South California on *Washingtonia filifera* H. Wendl., a palm that is becoming increasingly scarce

According to HUBBARD's statement (1899), this insect never deposits its eggs upon living plants; the author has however frequently found the holes by which it had made its exit on large and medium-sized palms which were not only alive, but appeared to have suffered no harm from the presence of the parasite. It is thus seen that the attacks of *D. wrighti* are not always fatal although they weaken the tree and frequently cause it to fall. In May 1917, the author examined in the Palm Cañon alone (South California) nineteen fallen trees, the victims of this parasite.

HUBBARD has stated that the insect never deposits its eggs in palm trunks which have long lain on the ground, but here again the author is of contrary opinion, for he obtained 133 adult beetles, 27 pupae and 17 larvae from the trunk of a palm that had been dead for several years as was clearly proved by its blackened extremities.

In the case of living palms, the holes by which the adult individuals of *D. wrighti* make their escape are usually situated at the base of the trunk, rarely near the top, but dead trees lying on the ground are perforated indiscriminately throughout their length.

G. T.

1008 - *Teracotona submacula*, a Macrolepidopteron injurious to several Plants in the Union of South Africa. — GUNN, D., in *Union of South Africa, Journal of the Department of Agriculture*, Vol. IV, No. 6, pp. 542-547, 1 pl. Pretoria, June 1921.

In 1919-1920 the kitchen gardens of Port Elizabeth and the neighbourhood were found to be infested by the Macrolepidopteron *Teracotona submacula* Walker (fam. *Arctiidae*) to an extent surpassing all records for the past fifty years.

The insect is a native species that is very common throughout the Union of South Africa and has been collected by the author at Pretoria, Johannesburg, Uitenhage and Bathurst. In the South African Museum there are specimens from Grahamstown, Port-Shepstone, Durban, Potchefstroom, Potgietersrust, Damaraland and Salisbury in Rhodesia. The larva of this insect, which is popularly known as the woolly caterpillar, is omnivorous, its favourite hosts however appear to be the cabbage, bean, beetroot and lettuce.

The youngest caterpillars as soon as they hatch out of the eggs deposited in small heaps on the stems and branches, devour the leaves, only the veins remaining intact. When half-grown, the caterpillars eat the whole leaf. They were sometimes so numerous in the private kitchen gardens and the market gardens of Port Elizabeth and its vicinity that all the beds of beans, beetroots, cabbages and lettuces were completely destroyed; the insects then passed on to the carrot beds and attacked them in the same way. *Ter. submacula* also causes great damage to flowering plants as the larvae devour the leaves and tender shoots and strip the stems quite bare.

The author gives in his paper a detailed description of the life-history and habits of the Macrolepidopteron. Its complete cycle of evolution lasts from a hundred and seventy-five days to a hundred and eighty-one days and there are two generations in the year.

The eggs of *E. submacula* are much parasitised by Chalcids; the larvae are effectively controlled by a Braconid and two parasitic Tachnids. A native bird, the cape robin (*Gossypha caffra*) lives on the caterpillars.

If the infested area is not very extensive, the larvae can be collected by hand early in the morning or in the late afternoon and destroyed by crushing or throwing into vessels containing water and petroleum or a soapy emulsion of petroleum or carbolic acid.

If the caterpillars are very numerous and the kitchen garden large, it is better to spray with aceto-arsenite of copper, or with lead arsenate in the form of a paste or powder. The application of these sprays is more effective if delayed until the larvae begin their attacks.

In order to make the liquid insecticide adhere better to the cabbage leaves an experiment has been made of adding a mucilaginous substance extracted from the branches of the Barbary fig. This mixture has to be used fresh. Instead of spraying the cabbages, they can be dusted over in the early morning with aceto-arsenite of copper and lime. For these plants however spraying with liquids having a lead arsenate basis, or com-

posed of aceto-arsenite of copper and lime has proved more efficacious than the application of powders.

In the case of flowering plants, or delicate specimens, spraying with lead arsenate, prepared preferably from the powdered form rather than the paste, is better than spraying with aceto-arsenite of copper.

As the adult caterpillars make their cocoons in the ground near the plants which provide them with food, the soil should be thoroughly worked in order to destroy any chrysalids that may be present. This was done with very satisfactory results during the summer of 1919-1920, when there were large numbers of cocoons. G. A.

1009 - *Phenacoccus hirsutus*, a Coccid injurious to various Plants in Egypt. —

HALL, W. I., in *Bulletin de la Société entomologique d'Égypte*, Year XIV (1921), pp. 17-29  
Cairo, 1922

It is highly probable that the coccid known popularly as the Hibiscus mealy bug was introduced into Egypt from India. It was first regarded as a new species for which the name *Pseudococcus hibisci* was proposed, though no description was published, but has since been identified as *Phenacoccus hirsutus* Green (1). This coccid was first reported from Mataria in 1912, but very likely it has existed at Abbassia since 1908. In any case, it is practically certain that Mataria was the first centre of infection whence the parasite spread throughout the district of Cairo. In 1915 the Mataria zone suffered severely, but it was not until the second half of 1918, that Cairo was infested to any considerable extent. The following year the coccid made its appearance in still greater numbers and destroyed many trees including not a few splendid specimens of *Albizia Lebbeck* growing at Gizah.

The attack, which was at first confined to Cairo, subsequently spread southwards as far as Beni-Suef and the Fayoum; its northern limits seem however to have been the village of Shubra and Abon-Zaabal. The wind is the chief agent of the diffusion of *Phen hirsutus* and as the prevalent wind in Egypt blows from the north it is only to be expected that the infested area is most rapidly extended in a southern direction.

This coccid is more or less omnivorous, but prefers trees and shrubs, especially those that have been weakened by age or the attacks of other enemies. Some of the most important of its hosts are: *Hibiscus* spp., *Morus* spp., *Albizia Lebbeck*, *Bauhinia* sp., *Grevillea robusta*, *Erythrina* spp., *Zizyphus* spp., *Ceratonia siliqua*, *Psidium Guajava*, *Acacia arabica*, *Parkinsonia aculeata*, *Robinia Pseudacacia*, *Cajanus indicus*. Annuals generally escape without much injury, unless they happen to be in the immediate neighbourhood of a centre of serious infestation. This applies especially to the cotton-plant which is very susceptible to the attack of the insect and suffers very severely if infested at an early stage in its development.

The plants attacked are conspicuous owing to the fact that the growing points become knotted and shrivelled which renders them unsightly and

(1) See *R. July* 1922, No. 797. (Ed.)



hinders or arrests their further development. Although the growing points are always the centre of attack, the coccid may be found on nearly every part of the plant. At the end of the summer the adult females seek the most suitable places for oviposition, in order that their eggs may be well protected from the winter cold. Large number of ovisacs are to be found in the crevices of the cortex.

The author gives a detailed description of each stage in the development of the insect and a long account of its life-history.

Fumigation has proved a successful means of controlling *Phen hirsutus* but it is necessary to consider how far it is to be recommended from the economical standpoint. Fairly good results have been obtained by spraying with petroleum emulsion provided that the diseased portions of the plant were also removed. The nature of the injury caused by the insect is such that no amount of spraying can really give the desired result. It is also necessary to state that should the plants be again contaminated by other diseased individuals in their vicinity — which it is almost impossible to prevent in Cairo — the last condition of the pruned tree is worse than the first, because the larvae have at their disposal young tender shoots on which they thrive apace. Repeated sprayings are certainly of use in preventing attack, but they are not fatal to the insect. The only way to exterminate the pest is to substitute more resistant species for the most susceptible host plants.

No natural enemies of *Phen hirsutus* have been reared in sufficient quantities for it to be possible to expect any help in this direction, at all events for the present.

The enforcement of the different legislative measures passed of recent years has greatly decreased the danger of any extension of the infected areas, while the suppression of the trees most liable to the attack of the parasite will almost certainly result in its eventual extermination.

G. T.

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FIRST PART  
ORIGINAL ARTICLES

**Note on cocoa growing in the State of Bahia (Brazil)**

by

DR JOAQUIM WANDERLEY DE ARANJO PINHO

*Victoria, Brazil.*

In Brazil the cocoa tree is indigenous and grows in the shade of the forest which covers the banks of the river Amazon and of certain of its tributaries, where it has its natural habitat. Even to the present day, it is seen wild in Pará and Amazonas, the most northerly States of Brazil. The Spaniards after having learned from the Mexicans the use of chocolate and found it to their taste, commended the exportation of cocoa beans to Spain; this export has been the cause of much fighting and smuggling. The Portuguese, to whom nature had given so valuable a tree without need of cultivation, turned their eyes to its fruit. Cocoa began to be sent to Lisbon from Pará, at that time the chief town of Capitania, the administrative division of colonial Brazil, which controlled the whole of Amazonia. Only the fruit of wild trees found on the banks of the rivers was collected and restrictions were not made because of the savages who inhabited these countries.

In 1678 a "Carta Regia" (Royal decree) ordered regular cultivation and this preliminary regulation was followed by others granting bonuses and reductions of duty on cocoa produced on regular plantations. The production of the cocoa plantations and that of the wild trees reached fairly high figures for the period: in 1778, it was 902 tons and, in 1818, 1524 tons. In Bahia cultivation is said to have begun in 1746, from seed brought from Pará by the French planter Louis Frédéric WARNEAUX. This seed was sown at Cubiculo on the banks of the river Pardo, in Canavieiras, by Antonio Dias RIBEIRO. The Portuguese Government took an interest in the cultivation and by its agents, known under the title

of "Conservadores das Florestas" (Conservators of Forests), tried to assist production. Reference may be made to the speech of FERREIRA DA CAMARA, one of these Conservators, at the Academy of Sciences at Lisbon, in 1789, in which he started a propaganda in favour of the cultivation of cocoa in Bahia and stated its advantages and profits. It is even said that the introduction and plantation of cocoa trees in Bahia was due to his efforts. In 1779, there were cocoa trees at Rio de Contas and at Cayrú and in 1802 at Santarem the people cut down the trees "for they were of no use to them."

Von MARTIUS said in 1819 that the cultivation had had a successful beginning, but that at that time it was almost non-existent and that one could see at Camamú trees which proved that the region was favourable for them. It was only in 1820-1822 that it was introduced at Ilheos. Pierre WEYLL, and his companion SANARAKER having obtained a "Sesmaria" (land granted by the king in perpetuity) in 1818, brought in German planters on two occasions, to colonise this land. At that time people were interested in the cultivation of sugar cane and coffee, but the cocoa tree was also planted; old cocoa trees of this first plantation by the Germans are still shown at Provisão. That plantation was the nucleus of the cultivation at Ilheos. In 1778, the export of cocoa from Bahia was 900 kg.; cultivation developed slowly and in 1835 the export reached 26 805 kg. The statistics show the increase of exports which continue to grow yearly. It was not until after 1890 that the cultivation made a great advance owing to the high prices given for cocoa.

At that time the export from Bahia was 3 502 tons and that of Amazonia 3 387; in 1900, the export from Bahia had risen to 12 131 tons and that of Amazonia did not exceed 3 085 tons. Amazonia, which was the principal producing State, gave place to the State of Bahia, which at present yields 90 % of the Brazilian export and by itself occupies the second place in the world's statistics for countries producing cocoa. The growth of cocoa is the most valuable product in the State of Bahia and accounts for 25 % of the Budget receipts

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The cocoa plantations in Bahia occupy the southern part of the State, from the mouth of the river Jequiriçá to the boundaries of Espírito Santo. This area has an extent of over 500 km. along the coast and varies in width from some ten to more than 100 km., and possesses the conditions required for the crop.

In some parts planting is not possible and generally the land near the sea must be left out. In certain places planting is done near to the sea; in others it is necessary to go inland to avoid sandy soil and wind.

In this area plantations are not regularly distributed; they are grouped around centres, sometimes separated by long stretches of virgin forest, while others continue without interruption over large districts.

The producing centres may be divided into three groups:— the first

which stretches from the river Jequiriça to the river Una, in which are found some important centres such as Jequié, Rio de Contas and Ilheos, the largest of all the districts ; the second, which is situated on the banks of the rivers Jequitinhonha and Pardo ; the third formed of isolated plantations. A river and its tributaries always form the centre of radiation of plantations. In the first group, the plantations are made on the banks of the rivers and numerous streams, on the hills, on their slopes, in the intermediate valleys, in short wherever the cocoa tree seems able to live. In the second group, the plantations are made on the banks of the rivers, on the rich alluvial plains, often inundated by high floods, for which reason new plantations are made on higher ground. The third group shares the conditions of the first two. The difference between the first two groups is also shown by the quality of the produce. The cocoa coming from Belmonte and Cannavieiras, of the second group, is better prepared and of better quality, and in Jequitinhonha are found the best equipped and best cultivated plantations.

The first group on the contrary, although it produces good cocoa, and has good plantations, is divided up into small farms under numerous proprietors who cannot give the produce the necessary care. This group, in which are Ilheos, Rio de Contas, Jequié, Santarem, Camamú and Una, supplies almost 75 % of the total output of the State of Bahia. The centres of production are called after the names of the communes or the ports of shipment, as, for example, Ilheos, which controls the produce of two communes :— Ilheos and Itabuna. Except Jequié, which makes use of the Nazareth railway for transport, all the producing centres ship from the ports up to Bahia. There are as many as 24 communes in which the cocoa tree is planted, but some of them are unimportant, either because planting is decreasing and is being replaced by other crops or because planting is in the experimental stage.

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The characteristics of the region in which cocoa trees are planted are :— regular rains, even temperature, humid atmosphere, presence of tropical forest, soils rich in humus or fertilising matter. Over so large an area, these conditions certainly vary, but on the whole, they are not notably modified. There are no great mountains in the whole of the area occupied by planting, but only low hills not over 300 m. in altitude. The plantations do not reach to more than half this height.

The cocoa tree can give good results at greater altitudes, but the transport of the crop would be difficult and as there is plenty of land, hills of a certain height form the future reserves. The rainfall averages 1800 mm. and falls every month. No month can be said to be wetter than another, as the distribution varies each year ; but at Ilheos it may be said that the wettest months are from December to May and that the dampest and coldest months are from June to September. There was a great drought in 1920,

but the only consequence was a decrease in the crop of the following year, and the trees have not suffered.

The humidity of the atmosphere is great, and often, during the night and early hours of the day, fog covers the plains, the savannahs and even the hills. The average temperature is from 25 to 27° C., the maximum 33° and the minimum 14°. Temperatures of 33° are recorded on very sunny days, followed by a drop to 18° the next morning.

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The soils on which cocoa is planted are generally very good, rich in fertilising matter and covered by dense tropical forest. Analyses have not been made and the composition of these soils is not known, but analyses would show that they possess good qualities. On the banks of rivers, in the plains and in the deep valleys between the hills, soils are found with deep beds of decomposing vegetable matter. Sandy loams and clay soils are most common and are those on which most of the plantations are made. On the slopes of the hills, very fertile, clay soils are formed by the decomposition of the primitive rock. Granitic soils are also met with, on which the forest trees grow well: these soils are also very good for cocoa. The rock should not be compact, and should be in blocks with interstices through which the roots of the cocoa tree penetrate, and the subsoil should not be formed of horizontal strata. Plenty of plantations on such soils and giving a good yield can be seen at Ilheus. At Belmonte and Cannavieiras, the predominating soil is of the humus type on the banks of rivers in the alluvial plains of the basins of the rivers Jequitinhonha and Pardo. In the other producing centres, good alluvial soils are also found, but clay soils predominate.

With the exception of Cannavieiras and Belmonte where the soils are better chosen and prove more fertile, planting is done without much regard to the conditions of the soil. It is only on sandy soils, in places where compact rock is met with, or else hard clay-sandy soils, or places where water accumulates and forms permanent marshes that no planting is done. It is certain that with this procedure, good crops will not be obtained, that the average production will be much lowered and that soils of poor quality should not be chosen while there are good soils from which to select.

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Neither the number of trees nor the area cultivated are known but only estimated. According to such estimates, the area covered by plantations is 104 200 ha., on which are planted 103 300 000 trees. There are about 5 800 000 young trees not yet in bearing or bearing very little, and about 97 500 000 trees in full bearing, old trees yielding very little and trees temporarily useless because of disease or the effects of floods, etc. The trees which no longer bear fruit are not included.

These figures are approximations only and the author hopes to make a fresh investigation to verify them. If the parts be included which are still unplanted, where there is forest, pastures and other crops, the area may be doubled and the area occupied by cocoa cultivation will thus be found to be nearly 210 000 ha.

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Three kinds of cocoa trees are planted in Bahia, known under the local designations of Common Cocoa, Pará Cocoa and Maranhão Cocoa.

The Common Cocoa, which may be classed in the "Amellonado" type of Van HALL, has large, wrinkled fruits, almost cylindrical in the middle and narrowing at both ends. The tree grows more in height than in breadth and the leaves are of medium size, rounded at the base and undulate between the nerves. The beans are of good size and less flattened than those of other kinds. It requires more care in cultivation than the other varieties and only gives satisfactory results on soils of good quality and when sheltered from the wind. Under good conditions this species yields well and lives a long time, but is later before beginning to bear than the others.

The Pará Cocoa, which may be classed under Van HALL's "Callabacillo" type, has rounded fruit, with a smooth, thin shell. The beans are very flattened and the leaves are longer and thinner than those of the Common Cocoa. It does not require good soils and grows more rapidly than the other kinds and has a tendency to develop more in breadth than in height but is very sensitive to lack of moisture. It appears that this kind is the result of hybridisation between the Common Cocoa and the Maranhão Cocoa.

The Maranhão Cocoa resembles the Common Cocoa in having slightly longer and larger fruits than those of the Common Cocoa, the fruits are as wrinkled or even more so than the latter, and the tree grows more in breadth than in height. The beans are less flattened than those of the other two kinds. Its root system is more superficial, which makes it suitable for shallow soils.

Hence, it may be concluded that the Common Cocoa should be preferred for good deep soils and that the others should be planted on poorer quality soils. At Belmonte and Cannavieiras planters prefer to grow the Common Cocoa and at Ilheus the two other kinds.

With regard to yield, it appears that the Common Cocoa fruits more regularly and more abundantly; the other kinds have high yields, followed by a decrease, and do not maintain a steady production.

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The yield per tree and per hectare is very variable: planting is done at various spacings, from 625 up to 1000 trees per hectare. The kind planted and the quality of the soil cause variations in the yield per tree. At

Belmont and Cannavieiras, the average yield of a tree may be estimated at 750 grammes and at Ilheus at 650 grammes, figures which must be reduced for the other centres. The production per hectare may vary from 540 to 1200 kg. and yields of 2000 kg. per hectare and 4 kg. per tree have already been obtained.

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The cocoa tree is almost always planted in virgin soil in places previously under forest.

For this the forest is completely cut down, the felled timber is burnt and the ground is prepared by cleaning up the débris left by the fire. Generally planting is not done for some months after the cleaning, as felling is done in the dry season and planting when there is rain. The native vegetation of the ground is a guide to the planter as regards the quality of the soils, and the growth of certain trees is also a good indication. After the ground has been prepared the places where the cocoa beans are to be planted are marked by means of stakes 1.30 m. in height. Before planting the cocoa trees, temporary shade trees are planted, generally manioc or bananas, and a few months later the planting of cocoa trees is begun. The distance between the stakes, and consequently between the trees, varies from 3 m. to 4.25 m. in new plantations, while in the old plantations it was as little as 2 m. The kind of cocoa tree planted also determines the distance; for the Common Cocoa planting must be closer, as it grows more in height than in breadth.

The usual method is to plant three beans round the stake; as the young plants which spring up are allowed to grow there is often a group instead of a single tree. In Bahia shaded cultivation is not practised and for this reason trees are not planted for permanent shade; after the temporary shade is withdrawn, fast growing trees of the secondary forest which grows up after the old forest is felled, are used for the young cocoa trees. In course of time the trees cover the space with their branches, and shade the whole ground at which time it is said that the plantation has "closed up". The plantations are formed by means of clearings opened in the forest called "roças", having a variable number of cocoa trees (up to 5000). The "roças" are separated one from another by zones of trees of the original forest; a collection of "roças" forms a "fazenda", which is a variable number of small plantations separated by large trees. These trees serve as protection against wind and the sun.

These zones of trees are now being removed in order to join up the "roças" and large extents of cocoa trees without any shade may be seen. So long as the plantation has not "closed up", which happens in the fifth year, the cocoa plants must be freed from weeds and vegetation which grows vigorously; weeding is made 3 or 4 times a year. After the plantation has "closed up," it is only necessary to weed from time to time as the shade prevents weeds from growing.

The care given to cocoa trees is limited to cutting a few dead branches,



adventitious branches and to freeing them of parasitic plants. No regular pruning is done and almost all planters are against it. Many planters pay more attention to the trees, but nowhere can it be said that the culture is scientific and methodical, or that the attention necessary to obtain the highest yield is given owing to the fact that with present methods and current prices, good profits are obtained. The lack of experimental stations (which are non-existent) and of experts to give practical instruction and show the planters the advantages of intensive cultivation causes the planter to be guided by experience and tradition, and the cultivation to be maintained almost in its primitive state.

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The cocoa tree begins to bear fruit from the fourth year for the Pará and Maranhão kinds and from the sixth to the seventh year for the Common cocoa. The first fruits are few in number and scattered on the trees which should not enter into full bearing before the eighth year. However it bears some fruit, so that the plantation from the beginning gives a return to the planter for which reason the early fruiting species are usually grown.

The plantation is made either by the proprietor himself, or by labourers with whom he makes a contract. Under this procedure, the contractor takes possession of the ground, fells the forest, plants the cocoa trees, uses the land for his catch crops, and, at the end of the time arranged, receives in payment a sum previously agreed on for each tree planted. This is one of the reasons why cocoa cultivation is done with little capital or, more correctly, with the sole labour of the small planter.

\* \*

The cocoa tree bears fruit all the year round; the fruit ripens in May in small quantities, and the yield increases up to July, when production is almost suspended; the crop of the early months is called "temporã", this preliminary crop is followed by the regular crop, "safra", which lasts up to April, when it ends. The months of full bearing are generally from September to January, and in Bahia the crop years are counted from May to April.

\* \*

When the fruits turn yellow they should be gathered, which is done by means of bill hooks fitted on to long poles. The fruit which falls is collected into heaps and opened with large knives and the beans are extracted by hand. The cocoa beans are then taken to the fermentation houses. The methods of harvesting differ very little in the various countries.

\* \* \*

Fresh cocoa (called "soft cocoa"), when it reaches the fermenting house, is placed in depots called "cochos". These are wooden boxes measuring about 1 m. in height, 1 m. in width and 5 to 8 m. in length. Some planters use boxes with small holes bored in the bottom for the escape of liquor formed during fermentation, others prefer them quite water-tight. Good results are obtained with both systems. During fermentation the cocoa is covered with banana leaves, sacks, etc., and is turned over every day. Fermentation is more or less rapid according to the quality of the cocoa and the state of the weather and lasts from five to eight days.

Experience is necessary to judge when the fermentation process is ended.

\* \* \*

When fermentation is over, the cocoa is taken out of the "cochos" for drying. Drying is generally done in the sun on wooden floors which can be covered with a corrugated iron roof to protect them from rain. These drying places vary in dimensions according to the requirements of the plantation and are of two types:— 1) "Balcons", super-imposed moveable floors on rails at different levels, having a single common cover; 2) "Barcaças", formed of a single fixed floor, the cover running on rails. The first type is much used at Cannavieiras and Belmonte, and the latter at Ilheos. Drying places with artificial heat, called "estufas" are also used, they are constructed in different ways, but based on the same principle. These drying places consist of a structure, into which a truck with several drawers of perforated tin is run and a heated chamber. At Belmonte a dryer of the "Guardiolo" type is in use, and another type with mechanical movement is installed at Ilheos. These dryers all have defects and no agreement exists at present as to which is the best type. The best cocoa is obtained by drying in the sun. Drying lasts for three to eight days, and should be done slowly so that the cocoa may dry completely.

To give the cocoa a shining appearance, it is subjected in the dryers, while still moist, to "pisagem", an operation identical with "dancing" in Trinidad: barefooted men collect the cocoa in small heaps on the drying places and tread on the beans for about an hour; when it is over the cocoa continues to dry and, when quite dry, it has a polished shiny appearance.

\* \* \*

The cocoa when quite dry is taken to the warehouses where it is weighed and put into sacks. At Cannavieiras and Belmonte transport is by river in "canoas" (canoes) up to the shipping ports. In other centres donkeys are used forming "tropas" (collection of several donkeys under control of one or more men). To reach places where transport is easier, that is to

say either a navigable river or a railway station, the "tropas" travel by very rough paths. The dangers, accidents in crossing streams and marshes where the animals sink up to their necks and sometimes fail to get out, the passage through the forest and the descent of hills where the paths follow the slope directly, make transport difficult and reduce the quality of the cocoa. As soon as the cocoa reaches its destination or the shipping ports, it is classified under commercial types in the warehouses of the big merchants, and made up in large lots and mixed in order to render it more uniform. The cocoa is then packed in bags of 60 kg. and shipped either on sailing ships or small steamers which call at the various ports. Almost all the cocoa is sent to Bahia, whence it is despatched to foreign countries. During the war shipping was done at Ilheus for Rio de Janeiro, where transshipment was made to transatlantic vessels; it is for this reason that the statistics from 1914 to 1919 indicate a great increase in the export of cocoa from this port. At present small quantities are sent from Cannavieiras and Ilheus to Rio for local consumption. Bahia is the market and port of despatch for cocoa of the State of Bahia.

\* \* \*

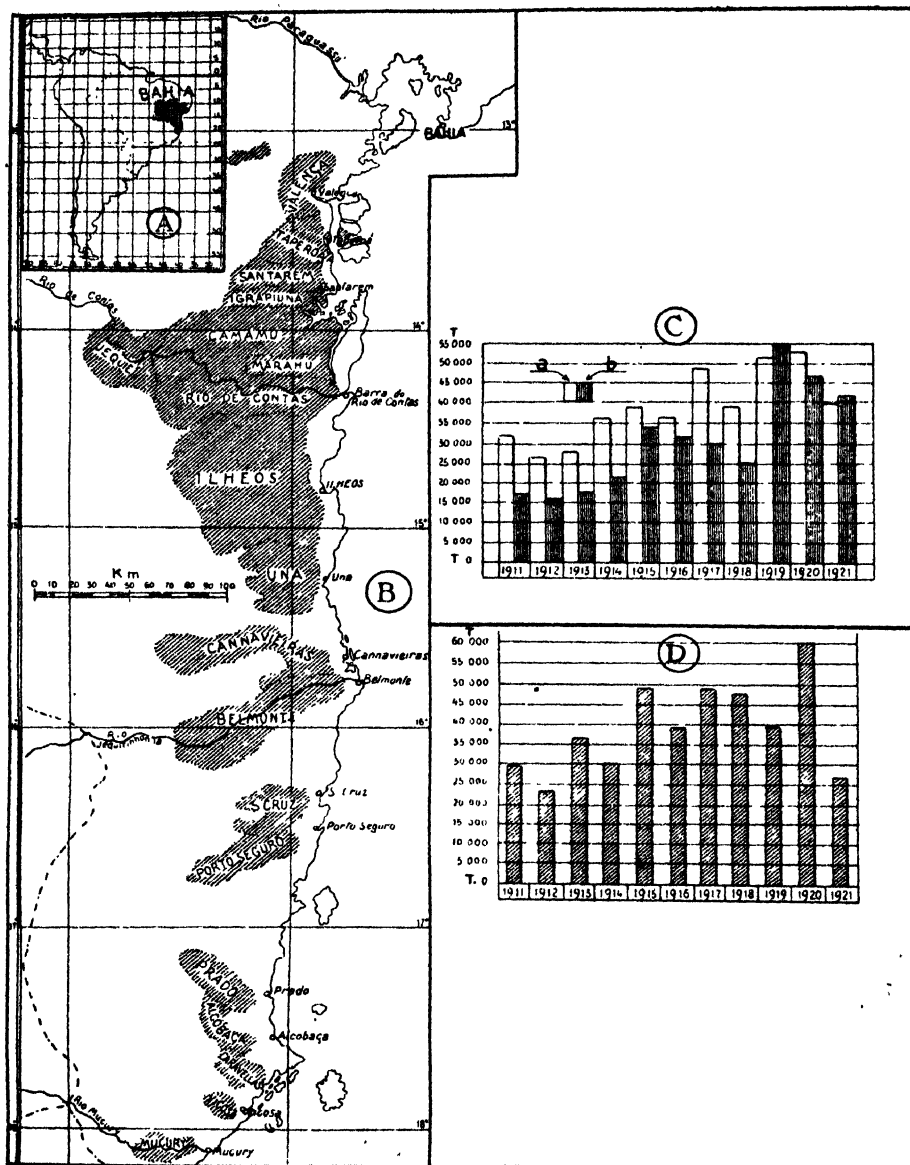
On the market, cocoa is classed under three kinds:—"Superior", "Good Fair" and "Fair". The "Superior" cocoa is shiny, dry and without external defects and has an odour like chocolate; when cut, not more than 2 to 4 % of internal defects are found. The "Good Fair" should have the same qualities on a smaller scale and not more than 8 % of internal defects. The "Fair" is badly prepared cocoa, of poor appearance and in which the defects are as high as 25 % or more. Local purchases are made per *arroba* of 15 kg. and, at Bahia the accounts of the brokers are passed for quantities of 10 kg. Exporters make their offers on the basis of 50 kg. but shipments are made in bags of 60 kg. net.

The difference in price between the kinds is variable and has reached as much as 2\$ (3 francs at the rate of exchange). The price in the Bahia market is also very variable, but the average, for the past few years, has not fallen belows 12\$ (12 *milreis*) for 15 kg., and the market depends on the prices in the New York market.

\* \* \*

The estimates of the net cost of a plantation are too long to be shown, but it may be said that a cocoa tree costs from 2\$500 to 3\$ (4 to 5 francs) everything included:—cost of land, staking out, planting and maintenance for five years. For plantations which have drying installations 4\$ per tree is calculated, the price 30 *contos* per 1000 *arrobas* of production (50 000 francs for a production of 15 000 kg.) is taken as a basis for the purchase of a plantation. The cost of harvesting, preparation and drying the cocoa is small and we may calculate 250 *reis* (40 centimes) per kg. or 2\$250 per 15 kg. at the plantation. If the calculation is made to include transport to the

# EXTENT AND PRODUCTION OF COCOA CULTIVATION IN THE STATE OF BAHIA.



## EXPLANATION.

- A = Situation of the State of Bahia in Brazil.
- B = Extent of Cocoa cultivation in the State of Bahia.
- C = Export of cocoa from the State of Bahia :—
  - (a) in tons ;
  - (b) 1 mm. corresponds to 2000 *contos de reis* (2832 fr. at par).
- D = Cocoa production of the State of Bahia, in tons.

TABLE I. — *Export and crop yield of cocoa of the State of Bahia, Brazil.*

Years	Exports				Principal Crop (« Safra ») bags of 60 kg
	Foreign		Brazil		
	tons	milreis	tons	milreis	
1911 . . . . .	3 1447.995	17 059 460	315.463	175 915	493 217
1912 . . . . .	26 687.784	15 364 479	343.479	399 633	384 780
1913 . . . . .	27 950.049	17 787 704	437.406	298 791	612 494
1914 . . . . .	36 457.274	21 608 284	770.439	454 835	496 644
1915 . . . . .	39 004.236	34 253 360	1 224.528	996 239	820 335
1916 . . . . .	36 249.345	31 459 294	2 723.876	2 398 646	652 795
1917 . . . . .	48 489.102	30 013 235	1 655.180	1 114 528	814 512
1918 . . . . .	39 097.325	25 088 573	2 376.718	1 470 417	799 411
1919 . . . . .	51 312.022	54 902 917	650.213	669 475	660 541
1920 . . . . .	52 260.701	46 497 751	755.376	772 031	1 005 169
1921 . . . . .	39 575.778	41 890 516	358.000	378 776	436 732

1 milreis = 2.832 fr. *al par.*TABLE II. — *Extent of cocoa cultivation in Bahia (estimates).*

Cocoa trees in production	Young Cocoa trees	Total Cocoa trees	Area planted
97 500 000	5 800 000	103 300 000	104 200 ha

TABLE III. — *Imports of Bahia cocoa (in tons)  
into the principal importing countries, from 1911 to 1921.*

Years	United States	France	Great Britain	Germany	Holland	Argentina
1911 . . . . .	7 180.210	4 670.878	7 012.977	10 338.341	944.065	961.930
1912 . . . . .	6 567.691	4 287.221	8 687.347	6 038.666	394.669	1 034.751
1913 . . . . .	10 300.772	3 294.988	10 330.652	2 469.246	1 19.710	1 041.788
1914 . . . . .	11 153.694	4 142.610	11 624.814	5 941.413	465.269	579.826
1915 . . . . .	13 976.522	5 375.127	6 558.286	—	4 392.588	985.106
1916 . . . . .	13 921.687	12 671.287	5 262.339	—	2 236.614	1 261.328
1917 . . . . .	32 136.049	7 528.519	4 563.695	—	1 197.619	1 150.831
1918 . . . . .	26 004.668	5 451.142	3 003.088	—	—	3 069.758
1919 . . . . .	32 135.902	6 302.093	2 821.410	2 400.000	1 607.106	1 156.852
1920 . . . . .	26 854.192	6 279.580	299.596	6 674.980	4 385.004	2 155.270
1921 . . . . .	16 389.000	1 078.000	162.000	8 693.000	3 225.000	1 739.000

warehouses of the buyers at ports of shipment the cost per 15 kg. (1 *arroba*) would be from 4 \$500 to 5 \$ (7 to 8 francs) an amount which, with the transport to Bahia, would amount to 6 \$500 — 7 \$. The present average price is 16 \$ per 15 kg. and it is evident that the planter has a margin to cover the cost of upkeep of the plantation, which is very small, and to pay interest on the invested capital. This capital, that is to say the capital invested in cocoa planting in Bahia, allowing that the value of a cocoa tree in 3 \$ and that the estimate of the number of trees is correct, is 310 000 *contos*, or, at present exchange, 516 000 000 francs.

\* \* \*

The State of Bahia imposes duties amounting to 19.5 % of the commercial value on cocoa exported either to foreign countries or to other States of Brazil. The average of the market prices during a fortnight is taken and this average is fixed as the value for the next fortnight. The Communes also tax the cocoa which crosses the limits of their territories to the extent of 250 to 200 *reis* per 15 kg. The State taxes are calculated at Bahia, where the cocoa arrives already burdened by the cost of transport, etc. and in consequence taxation exceeds 25 % of the value of the produce in the producing centres.

\* \* \*

The cocoa tree in Bahia has also its diseases, caused either by fungi or by animals, but they are neither very important nor serious in character. With cultural attention and supervision in the most infested countries the diseases will disappear. At Ilheus in 1919 trees were damaged in some districts and looked as if they had been burnt. A Commission studied the matter and ascertained the presence of *Thrips*, "mosquilla" and other injurious insects. Without any remedy other than the rain, which had previously been deficient, the trees regained their former appearance and bore well. It is always necessary to be on the look out, for the germs of disease are there and at any time there might be a serious outbreak. In principle, it may be said that diseases of the cocoa tree do not exist to such an extent as to endanger production and local conditions do not favour propagation of disease and that the trees are resistant to their pests, but care is always necessary (1).

\* \* \*

The cultivation of the cocoa tree is still progressing in Bahia; fresh plantations are made in the principal producing centres, but not to such an extent as to cause a great increase in production. As one gets away from the shipping centres and transport has to be done over considerable

(1) See R. April 1918, No. 493. (Ed.)

distances, by roads which are impracticable when it rains, the crop scarcely pays the cost of transport and does not give the planter a profit. Labour also is insufficient and the casual labourers who used to come from the north of the State no longer do so. These two factors, viz., difficult transport and want of labour, are the principal causes which prevent expansion. There are also the old plantations, trees attacked by disease, those which, owing to bad upkeep have become almost useless, those damaged by floods, and in short all the plantations which bear little or nothing and it will be seen that no great increase of production is to be expected. In the writer's opinion, during the next five years, crops exceeding an average of 850 000 to 900 000 bags of 60 kg. per annum cannot be counted on. Progress of the crop depends mainly on transport, the cost of which must correspond with the market prices of the product. The planter ought not to pay for transport almost the value of the product. If railways cannot be constructed, roads for transport animals would be sufficient, provided that they are well maintained. Localisation of labour would be a second requirement to do away with casual labour which is often lacking and hence causes wages to increase. Lastly Government measures are wanted for the protection of planting by laws giving prizes for good produce, prescribing the construction of roads, decreasing the export duties on cocoa, facilitating the acquisition of land and guaranteeing the rights of the first occupier, keeping good order and not permitting injustice, founding experimental Stations and instruction by agricultural officers in the producing centres to teach good methods, intensify rather than extend the cultivation, demonstrate the advantages of good product, in short to cause the cultivation to pass from the present primitive state to a state of scientific and methodical cultivation. Once these measures are taken, great progress may be expected in cocoa cultivation, and such measures are absolutely necessary to enable cocoa to withstand a fall in price which may be expected in view of the increase in the world's production, the protective measures taken by other countries and the rate of Brazilian exchange, at present very low but which may rise at any moment. It is certain that at the present time this planting gives good profits and remunerates in a fairly satisfactory manner the capital invested; and the writer strongly recommends the employment of capital in the purchase of plantations already in bearing. It is not reasonable that people should borrow capital at excessive rates of interest, and hope that the planting will provide for this interest, pay off the capital and in addition allow the planter a good income.

Cocoa-planting in Bahia offers excellent prospects for the investment of capital, provided that care is taken to select a plantation in good condition; with sound, economical management such a plantation would undoubtedly return a satisfactory income. The fall in the Brazilian exchange makes the present time very favourable for such investments.

SECOND PART  
A B S T R A C T S

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

RURAL  
HYGIENE

1010 - **Action of Vitamines.** — MITCHELL, H. H. (College of Agriculture, University of Illinois) in *Science*, Vol. 56, No. 1437, pp. 34-37. Utica, N. Y., July 14, 1922.

The discovery that small amounts of certain substances of undefined chemical composition are necessary constituents of a complete diet has opened up a wide field of research. Experiments have been made with animals by supplying them with rations deficient in certain vitamins. The study of vitamin A has been made with rats, vitamin B with pigeons; vitamin C with guinea pigs and monkeys. The results are consequently not always applicable to other cases; for example foods deficient in vitamins A, B and C for the animals in the experiment may contain sufficient for the requirements of human beings and domestic animals.

Although large amounts of meat or meat extract will not adequately protect guinea pigs from scurvy, in the case of human beings, even a relatively low concentration of the vitamin in meats will prevent an out-break indefinitely. In the case of human requirements, therefore, fresh meats should not be considered deficient in vitamin C though such is the case with the guinea pig.

For this reason it is premature to generalise from the results so far obtained; for example, milk and butter have a high growth vitamin or liposoluble A content, which may be entirely lacking in the case of hydrogenated fats or vegetable oils and this fact is made use of in arguments against the employment of these oils. It is very doubtful, however, whether such foods are deficient in vitamins from the human standpoint to such an extent that it is necessary to replace them by others which are richer in these substances.

On the other hand probably the functions of the growth vitamin are confined to the period of active growth; adult rats have been maintained in good health for over a year on rations devoid of this vitamin.

At the Illinois Agricultural Experiment Station, 4 sows have successfully raised in less than one year, two litters of pigs each, although the



ration, according to the tests with rats, was nearly if not entirely deficient in vitamine A.

The theory of vitamines may also be exaggerated in other ways

The English Medical Research Committee for instance states in a recent report that a deficiency in vitamine may be responsible for ill-health, but such a statement is based on conjecture and probability and ought not to be accepted as a fact. The part played by vitamines is at present hypothetical and views respecting food requirements of human beings and animals which are merely based on hypotheses ought not to be accepted without due consideration.

L. V.

1011 — Influence of the Weight and Size of Seeds on Yield. — DESPREZ, F., in *Journal d'Agriculture pratique*, Year 86, No. 7, pp. 141-143. Paris, Feb. 18, 1922.

AGRICULTURAL  
EXPERIMENTS

It has always been admitted that the largest and heaviest seeds gave the best cultural results.

VARRO, COLUMELLA, PLINY and in more recent times OLIVIER DE SERRES, P. JOIGNEAUX, SCHRIBAUX, etc. have recommended this mechanical selection for obtaining the most vigorous plants and the greatest yield. Some agriculturists however have attributed but slight importance to these characters of the seed. Thus, the Belgian agriculturist DE CALUWE published a pamphlet in 1908 in which he set out the results of experiments carried out at the "Jardin d'Essais" at Ghent with oats and barleys which were unfavourable to large seeds. Further, basing his conclusions on tests made by JANNESON, of the Glasterberry Station in Scotland, by TH. REMY, of the Agricultural College of Bonn-Poppeledorf in Germany, and others he came to the conclusion that the results of practical and carefully arranged experiments tended to negative the superiority of large heavy seeds.

The writer refers to some experiments made by him since 1896 at the Agricultural Experimental Station of Cappelle (Nord) with 5 varieties of wheat sown on 5 plots of an area of 20 ha. each; one half of each plot was sown with large seed and the other with small. The superiority of the large seeds, so far as the yield of grain calculated by weight was concerned, was evident and in some cases very marked. The difference was greatest in the case of a yellow bearded wheat for which the large seed gave a yield of 4800 kg. per ha. and the small seeds a yield of 3898 kg, a difference of 902 kg. per ha. For the other varieties, the difference, though less marked, was still considerable (kg. 125 — 275 — 282 — 367). The specific gravity of the grain (weight of 1 hl. expressed in kg.), was the same for two varieties and for the other three, that of the large grain was slightly greater than that of the small grain. There was no appreciable difference in the weight of the straw.

In 1922 fresh experiments were undertaken at the Cappelle Station with oats and barley so as to have them under conditions identical with those of DE CALUWE.

L. V.

## CROPS AND CULTIVATION

AGRICULTURAL  
METEOROLOGY

1912 - **Critical Period of Wheat as regards Rain.** — AZZI, G. (Director of the Department of Agricultural Ecology), in *Nuovi Annali del Ministero per l'Agricoltura*, Year 1, No. 2, pp. 299-307. Rome, Dec. 31, 1921.

In the development of cereals critical periods are encountered during which the plant feels most acutely the unfavourable effects of its environment, such as drought.

In the case of wheat the greatest need of moisture is felt : 1) during germination and the initial growth of the young plants ; 2) during growth ; 3) during the period of earing. The critical period for the formation of ears was previously determined by the writer by means of the formula of correlation and by making use of statistical, meteorological and phenological data ascertained for the Province of Girgenti. It follows that the period of about twenty days required to form ears is of capital importance ; if, during this period the total amount of atmospheric precipitation is less than the minimum compatible with the normal development of the plant, the harvest will be poor, even if rain falls during the remainder of the growth period. Wheat can give good crops even with a total rainfall of less than 300 mm. ; but as the minimum is approached the influence of the distribution of the rainfall prevails and becomes decisive during the critical period.

In this connection the writer has investigated experimentally 4 varieties of wheat : *Apulia* (Rieti × *Spelta*), *Cervaro*, *Carlotta Strampelli* (Rieti × *Massy*) and *Spelta*. The experiment was carried out at the Botanical Garden of the University of Rome during the agricultural year 1920-1921. The plants were grown in pots ; copiously watered from sowing on December 29 up to April 12, and from the 7<sup>th</sup> day after forming ears up to maturity ; during the interval, on the other hand, the plants were given a variable number of waterings : 0 — 1 — 2 — 5. The best selected varieties, of high specific productivity, *Spelta* and *Carlotta*, suffered most from the absence or slowness of the watering, the two other varieties were less exacting.

The harmful effect of insufficiency of water during the critical period is shown by : — the total production of grain expressed in weight — the average weight of the grains — the length of the stalks — the length of ears — the weight of straw — etc. There was also a delay in earing and reaching maturity, more noticeable for the selected varieties, especially *Carlotta Strampelli*. The length of the ears did not diminish correlatively with the length of the stalk ; on the contrary, in the variety *Apulia*, in spite of want of moisture they maintained an almost invariable length. This capacity of decreasing the length of stalk while maintaining the length of ear unchanged, may be interpreted as a character of adaptation to drought.

With the varieties *Spelta* and *Carlotta*, not even as many as 5 waterings

made in the conditions of the experiment were sufficient for them to reach the production of the two other varieties.

Production therefore depends on two factors : specific productivity and resistance to the unfavourable conditions of environment. In the 4 varieties studied, these two factors were more pronounced in the *more hardy* varieties. The variety *Cervaro* especially seems to unite in the best proportions the characters of specific productivity and resistance to drought ; it is well suited to a dry climate.

Adaptation to drought may arise : — 1) by advancing or retarding the formation of ears so as to alter the critical period ; 2) if the roots are deep ; 3) if the structure of the plant is such as to enable it to economise moisture. This last is true resistance to drought, and the real object of these experiments.

L. V.

1013 — **Plant Indicators of Soil Types.** — KELLEY, A. P., in *Soil Science*, Vol. XIII, No 6, pp. 411-423. New Brunswick, N. J., June 1922.

From ancient times, it has been observed that the presence of certain plants shows the condition of the soil on which they are growing ; CATO, PLINY and COLUMELLA noted the correlation between the soil and the flora. The idea was developed during the eighteenth century, and in the nineteenth century two schools of thought arose, one, represented by NAGELI, SCHIMPER and others attributed the chief importance to chemical conditions, and the other believed in the physical theory founded by THURMANN. Although many of the relations existing between soil and flora have been discovered, comparatively little work has been done in correlating plants with soil types.

The author has undertaken a series of researches with the object of determining whether a general hydrogen-ion concentration may be assigned to each of the soil types of southeastern Pennsylvania, and whether a definite relation exists between these soils and the flora growing upon them. He tested many soil types for acidity by the colorimetric method which is the most practical. Borings were made with an auger to the depth of 10 ft. in some cases. It was found that the carbon dioxide in the soil did not affect the reaction.

The acidity of a soil type is a variable quantity, but an average pH value may be assigned to each type. The values obtained represent surface soil conditions ; some borings were made with a soil auger, but not enough data are accumulated to formulate conclusions as to the acidity.

Soil acidity is governed in part by such factors as arrested leaf decay, and physiographical features of slope, degree of slope and relative elevation. Some types of soil seem to have a higher degree of acidity in late summer. Soil acidity influences flora to such an extent that certain plants may be assigned as indicators. The author gives a list of the characteristic species for 7 different types of soil. Thus *Quercus alba* is typical of rich neutral soil ; *Quercus stellata* is characteristic of poor soil with a high magnesium content ; *Quercus pinus* is the dominant tree of acid soil.

Soil acidity may perhaps induce variation in plant species.

A. de B.

[1012-1013]

SOIL PHYSICS  
CHEMISTRY,  
AND  
MICROBIOLOGY

1014 - **The Control of Soil Moisture by Means of Auto-Irrigators.** — DE PEÑALTA, F. (Department of Plant Physiology, College of Agriculture, Los Baños, Philippines), in *The Philippine Agriculturist*, Vol. X, No. 10, pp. 467-477, figs. 3, plates 1, bibliography of 4 works. Los Baños, Laguna, May 1922.

LIVINGSTON and KORETSU consider that a soil is satisfactory for plant growth if it can supply water to the root system as rapidly as required; otherwise growth is checked. With these points in mind, the author has investigated the relation of growth to different moisture contents when these are controlled by means of auto-irrigators or provision made for maintenance at the same level by means of a regular supply of water.

A modified LIVINGSTON auto-irrigator was employed. Three vertical cups (irrigators) connected by glass tubing provide the cultures in pots with moisture. A constant supply of water is afforded by means of a mercury control-tube, the free end of which is placed in a water reservoir. For each pot containing oven dry soil, 3 auto-irrigators were employed with a single reservoir. Three parts of pulverised loam to 1 part of coarse sand were used. The height of the mercury in the tubes varied from 40 — 20 — 10 — 5 cm., and zero. The soil moisture determinations gave respectively: 9.39 — 10.4 — 12.29 — 14.43 — 25.11. In the control pots, the moisture determinations were taken twice daily.

*Lactuca sativa* was used.

In both sets of experiments, there was an increase in dry weight in conjunction with the increase in soil moisture. A constant supply gave more satisfactory results than the periodic and variable supply. The difference was more marked for the high percentage moisture content than for the low content. For example, continued use of the auto-irrigator, and without the mercury medium, gave 5.66 gm. of dry matter. Curtailed use, namely 25.11 % moisture, gave 3.22 gm. or a gain of 75.8 %. A 40 % mercury medium gave 0.88 gm. and a 9.39 % moisture supply gave 0.83 gm., or an increase of only 6 % dry weight.

Comparative Graphs indicate the vegetative growth obtained. In this case also, the use of the auto-irrigator apparently has a beneficial effect when maintained regularly, and not discontinued, but this influence was more marked for the low moisture content than for the high, the gain in leaf area being 155 % to 16 %.

Atmometer experiments were also made, and the general results were as expected. The comparative data will serve in future experiments.

L. V.

1015 - **Factors influencing the Determination of Sulphate in Soil.** — HIRST, C. T. and GREAVES, J. E., in *Soil Science*, Vol. XIII, No. 4, pp. 231-239. New Brunswick, N. J., April 1922.

The methods for the determination of sulphates may be divided into two classes, namely, gravimetric and volumetric. The gravimetric method is not as simple and exact as was formerly supposed. In the presence of salts and acids which influence the result in various ways, such as by the occlusion of salts present in the precipitate, or to a less extent by the solubility of the precipitate, a serious error may be introduced, sometimes

even as much as 5 %. The volumetric method, which consists in titrating the excess of barium chloride used to form the precipitate with potassium chromate, followed by a titration with iodine, also causes considerable errors.

The authors have made a series of experiments in order to ascertain the causes which give rise to the errors in the two methods of soil analysis. Experiments with solutions of chloride of sodium, potassium, aluminium and iron showed that sodium chloride has a slightly depressing effect which is somewhat more marked with potassium chloride; the chlorides of aluminium and iron introduced a positive error with the gravimetric method and a negative error with the volumetric. The effect of nitrates is much more noticeable, the alkaline nitrates causing a positive, and the aluminium and iron a negative error. In the analysis of sulphates in samples of soil, it is obvious that clarifying agents such as alum or lime cannot be used and that the centrifuge or a filtration method must be employed. In the experiments which were carried out the soil was mixed with water in the proportion of 1 : 5, but this ratio could be varied considerably. In the case of chlorides and nitrates ten minutes shaking of the soil and water was sufficient, but at least forty minutes were necessary for sulphates.

The volumetric method with chromate always gave negative errors, small in the case of normal solutions, but much greater if the solutions were concentrated or diluted. This method is however to be preferred on account of its rapidity and simplicity; when a fair degree of accuracy is desired a correction must be made for presence of iron, aluminium and nitrates.

A. de B.

**1016 - Presence of Cobalt and Nickel in arable Soil.** — BERTRAND, G. and MOKRAGUATZ, in *Comptes rendus de l'Académie des Sciences*, Vol. CI, XXV, No. 2, pp. 112-114. Paris, July 1922.

The existence of cobalt and nickel has up to the present appeared to be very localised and deep lying. The writers have recently been able to determine the presence of these elements in arable soil, in small quantities. A sample of garden earth, from the Pasteur Institute, gave under analysis: — 0.0037 per 1000 of cobalt and 0.0174 per 1000 of nickel.

A. de B.

**1017 - Tests of Vesuvian Bacteriology.** — ROSSI, G., and RICCARDO, S. (Istituto di Batteriologia agraria della R. Scuola Superiore di Agricoltura di Portici), in *Nuovi Annali del Ministero per l'Agricoltura*, Year 1, No. 2, pp. 241-255. Rome, Dec. 31, 1921.

The writers offer a contribution to the study of the micro-biological processes which take place in the formation of soils, by determining in them the successive development of the active microbial flora. The Vesuvian zone is admirably suited for this form of research, as it contains large tracts of soils bacteriologically sterile which gradually become covered with vegetation either spontaneously or under the influence of cultivation. In this region sterility is periodically caused: —

1) by the flow of lava;

2) by the eruption of ashes which almost always accompanies the falling in of the cone ; the case of 1906 was striking as it produced layers with a depth of as much as 25 cm. ;

3) by the action of sulphuric and hydrochloric acids contained in the air in the form of vapours and smoke or carried down by rain. In cultivated soils the ashes may be buried in the ground and they then have a beneficial effect ; otherwise they cause sterility.

The succession of macroscopic and microscopic vegetable species in the sterile Vesuvian zone was previously studied by COMES, but a bacteriological examination was not made.

The writers have studied the various bacteriological processes which took place in the soil. In this preliminary test they indicate the results obtained as regards nitrogen fixers, cultivated in the ordinary way with samples of soil in a soil infusion containing  $1\frac{1}{2}\%$  of mannite. In all soils of the circum-Vesuvian plateau zone they found the *Bacillus amylobacter* (*Clostridium pasteurianum*) present in the four forms described by ROSSI in 1908 ; they also found *Azotobacter*. They were of various sizes and shapes, granular, hollow, etc. At altitudes of 310 and 878 m. nitrogen fixing agents were completely lacking, both those of the *Clostridium* and those of the *Azotobacter* type. An exception must however be made of the "Colle Umberto" which arose in 1895-1899 and in 1906 was covered with ashes which were subsequently carried away by wind and rain. The young student F. S. SAUVE found upon it a few forms of *Clostridium*.

The absence of these bacterian species from some soils throws some light on the difficulty which may be met with in reafforesting Vesuvius. Even if a possible relationship between the rooting of some leguminous plants, such as the robinia and the broom, and the root bacteria is excluded, it is not impossible that one of the reasons for the frequent want of success in the rooting of woody plants may be found in the absence of certain bacterian species, assuming that other known factors are admitted. The interest of the problem is evident in any case, the Vesuvian zone presenting conditions peculiarly favourable to its solution. L. V.

1018 - **The Influence of Moisture and soluble Salts on the bacterial Activities of the Soil.** — GREAVES, J. E., and CARTER, E. G., in *Soil Science*, No. 4, pp. 251-270. New Brunswick, N. J., April 1922.

The authors had formerly studied the influence of moisture on the bacterial activities of the soil and the object of their new work was to consider the effect of various soluble salts upon the water requirements of the ammonifying and nitrifying organisms. The soil used in their experiments was of a sedimentary type with a high lime content and a water-holding capacity of 45 %, and possessed a very interesting bacterial flora. Samples of 100 gm. were each mixed with 2 gm. of dried blood and different quantities of various salts and were put into sterilised pots which were covered and weighed ; water was added in amounts increasing from 10 to 45 %. The samples for ammonification were incubated for a few days at a temperature of 28°-30° C, and then analysed ; those for nitrification were incubated

for 21 days ; every seven days the water content was made up to the initial percentages. The maximum for ammonification was reached : a) with 30 % moisture in the case of untreated soil (14 mg. ammonia in 100 gm.) and of those to which the following salts had been added : sodium carbonate, potassium carbonate, potassium nitrate, calcium carbonate, calcium sulphate, calcium nitrate, magnesium chloride, magnesium carbonate ; b) with 35 % moisture in the case of soils to which had been added : sodium sulphate, sodium nitrate, potassium chloride, potassium sulphate.

The samples to which the sulphate or nitrate of magnesium had been added reached their maximum with 25 % moisture.

The relative toxicity of sodium chloride, sodium carbonate, potassium chloride, potassium carbonate and calcium carbonate diminished on increasing the moisture ; for example, the addition of chloride or carbonate of potassium to a sample containing 10 % moisture reduced ammonification by 50 %, whereas with 45 % moisture the first salt lowered the result slightly and the carbonate had the opposite effect. In these instances the toxicity was due entirely to osmotic pressure. In the case of other salts tested in the experiments, especially with those of calcium and magnesium, toxicity increased with the moisture content, which suggests the conclusion that the result was not due to physical changes in the soil, but to the physiological effect on the protoplasm of soil organisms.

The untreated soils and those to which had been added carbonate, sulphate or nitrate of sodium, chloride, carbonate, sulphate or nitrate of potassium, and chloride or carbonate of magnesium, reached the maximum for nitric nitrogen production when the soil contained 20 % moisture, whereas the soils containing potassium carbonate, calcium sulphate, calcium nitrate, calcium carbonate, magnesium nitrate and magnesium sulphate reached the maximum with 25 % moisture. When the water-content reached 35 % nitrification ceased in all the pots except in that treated with sodium chloride, where it continued to some extent before the maximum was reached, with 30 % moisture. The addition of water to soils containing small amounts of potassium chloride, potassium sulphate, magnesium nitrate or magnesium chloride changes the toxic medium to one which is favourable for nitrifying bacteria ; for example, chloride of potassium is toxic in soil containing 10 % of water but with 20 % there was double the production of nitrates. Nitrate of sodium was the only salt tested, which, even in the presence of a high percentage of water, reduced the production of nitrates, notwithstanding that the passage from a toxic to a stimulating medium by increased water content was very pronounced in the case of sulphates, especially those of potassium, magnesium and calcium.

A. d. B.

1019 - **Influence of Hydrogen-ion on Growth of Azotobacter.** — GAINES, P. I., and BATCHELOR, H. W. (Department of Bacteriology, Kansas Agricultural Experiment Station), in *Science*, Vol. 56, No. 1437, pp. 49-50. Utica, July 14, 1922.

After isolation of several strains of *Azotobacter* from different soils and grown in dextrose media, the maximum hydrogen-ion concentration permitting growth was found to be pH 5.0-6.0 in every case. This

is appreciably lower than that reported (pH 6.6-6.8) for two strains by FRED, but agrees closely with previous work by GAINEV. As the hydrogen-ion concentration of the medium decreased, growth increased until pH 6.1-6.4 was reached.

No fixation of nitrogen took place in a concentration greater than pH 5.9, but at pH 6.3-6.5 fixation was as great as in lower concentrations. The growth of the organisms did not affect to any appreciable extent the concentration of the medium.

L. V.

1020 - **The Carbon and Nitrogen Relations of the Nitrite Ferment.** — BONAZZI, A. (Laboratory of Soil Biology of the Ohio Agricultural Experiment Station, Wooster, Ohio) in *Journal of Bacteriology*, Vol. 6, No. 5, pp. 479-490, bibliography of 15 works. Baltimore, Sept. 1921.

WINOGRADSKY has demonstrated that nitrite fermentation organisms are capable of growing in a medium completely void of organic matter in presence of air, which oxidises the ammonium compounds; nitrite fermentation is followed by an increase in carbon content, which indicates that a source of carbon is found and utilised by the organism. GODLEWSKY as well as WINOGRADSKY and OMELIANSKY, found that cultures of nitrite- and nitrate-forming organisms lacking free or combined carbon dioxide could not develop. BEIJERINCK suggests that the carbon is fixed by the basic carbonate in the culture liquid, and not utilised and assimilated by the organisms; but if this were true it is difficult to explain why the ratio of nitrogen nitrified to carbon assimilated should be of constant value. It appears that an intimate connection exists between these two factors; hence the view advanced by LOEW that this is due to a single biochemical process.

After making several experiments, the author has identified the source of carbon fixed by nitrite organisms. It has been demonstrated that organisms from American soils which differ in form and life-cycle from organisms from Europe and Asia, are similar physiologically. Using the OMELIANSKY solution, it was found that when fermentation occurs and changes the sulphate of ammonia to nitrites, the organisms have recourse to the energy derived from this exothermic reaction to regulate chemosynthesis of carbon, in other words to remove the free carbon dioxide and encourage carbon assimilation as a result of fermentation. A limited quantity of nitrogen is also used as an organic source; the nitrites are derived from the waste products.

The effect of magnesium carbonate or nitrous acid on ammonium carbonate is responsible for the liberation of free carbon dioxide.

By a special process, free carbon dioxide was removed from the cultures and a potassium or sodium carbonate absorbent employed to lessen the tension of the atmosphere and disperse that in the solution. In such cases, development is hindered. If this depletion of carbon dioxide in the cultures reaches certain limits, the nitrite organisms are incapable of action, which proves the absolute necessity for free carbon dioxide. This is obtainable from the carbonate but the organisms are unable to assimilate from the carbonate direct.



Nitrite bacteria are therefore essentially autotrophic, dependent on the presence of free carbon dioxide which leads to the formation of nitrous acid and its salts. The functions of autotrophic carbon assimilation and nitrogen nutrition are intimately connected, and mutually interdependent.

L. V.

1021 - **Effect of Tree Products on the bacterial Activities in Soil: Ammonification and Nitrification.** — GIBBS, W. M. and WEREMAN, C. II., in *Soil Science*, Vol. XIII, No. 4, pp. 303-322. New Brunswick, N. J., April 1922.

The greater part of the soil of northern Idaho consists of a silt loam. This area is covered with vast forests which are gradually being cleared by removing the timber *en masse* and burning the debris and each year there is an increase in the acreage of land available for agriculture. The first crop on this land is fairly good, but each successive crop is diminished for three or four years but after six or seven years better crops are obtained. This result is attributed to harmful substances left in the soil by the timber which disappear in six or seven years. The fairly good yield obtained from the first harvest can be explained by the small amounts of available plant food left in the soil, which are removed by the first crop.

The object of the author's investigations was to ascertain the effects of these harmful substances on soil bacteria.

FERNOW states that in a century the products formed from the leaves of a forest constitute 15 % of the soil ; in order to be well within the limit found in nature the authors used forest material in amounts varying from 1 to 3 %.

The samples were composed of saw-dust, bark and needles from different forest trees ; three types of soil were chosen for the experiment, forest, garden and field. Samples of soil weighing 100 gm. each were put into bottles of 500 cc. capacity, and 1 gm. of dried blood was added to each and the moisture content brought up to 25 %, and an additional 2 gm. of water for each gm. of wood or other tree product. The samples were incubated at a temperature of 28° C for a week, after which they were analysed for ammonia content. The samples for nitrification were prepared in the same manner except that the moisture content was made up to 20 %, and the incubation lasted four weeks ; the moisture lost by evaporation was restored each week.

The samples for denitrification were prepared in the same way as were those for ammonification, with the exception that sodium nitrate solution was added instead of blood.

All the substances which were tested reduced ammonification. In the forest soil, cedar (*Thuja plicata*) was the most harmful and reduced ammonia accumulation 78.9 %, the sugar maple coming next as regards toxicity. The white pine (*Pinus monticola*), the least toxic of the group, reduced it by 13.1 %. The results were very similar in the case of field soil. Cedar, maple and larch were the most toxic. Among the products other than sawdust *Thuja plicata* needles exerted the greatest inhibitory action, followed by those of *Pinus ponderosa*, *Pinus monticola* and *Abies grandis* ; larch needles had little effect.

All the substances tested proved to be inhibitory to nitrate formation from blood and ammonium sulphate. This effect is reduced but is not entirely removed by applications of 1 % of carbonate of lime.

Ash and maple sawdust in 3 % applications almost stopped nitrification. Cedar, maple, larch and Douglas fir sawdust caused the greatest reduction. Apart from sawdusts, applications of 3 % of white fir, yellow pine and cedar needles practically prevented nitrate formation. Notwithstanding the effect of the needles, white fir sawdust was but slightly detrimental. The forest residue which covered the soil also reduced both ammonification and nitrate formation. On the other hand, ferns, which abound on forest land, had little effect.

The denitrification experiments indicate that the reduction of nitrates is not due to the denitrifying group but to inhibition of the nitrifying organisms. With the exception perhaps of maple and ash none of the substances tested would serve as a source of energy for denitrifying organisms.

A. de B.

1022 - **Soil Fatigue.** — D'HUBERT, A., in *Journal d'Agriculture pratique*, Year 86, No. 7 pp. 136-138. Paris, Febr. 18, 1922

The writer defines the fertility of a soil as its capacity to produce vegetable matter, independently of its chemical composition. Decrease of fertility has been attributed to several causes:—

- 1) The most simple hypothesis is the soil's exhaustion in nutritive matter. Recent research has shown that this is not adequate, for the composition of soil solutions is, if not constant, at least almost invariable.
- 2) Another explanation of soil fatigue is furnished by RUSSELL and his collaborators who bring in *antagonism between the germs in the soil*, in which the injurious germs get the better of the useful germs. The former class is represented mainly by protozoa, which by phagocytosis would destroy the latter, represented chiefly by *Azotobacter*. The exhaustion of the fertility of the soil would be due to the rapid increase of the protozoa. This is perfectly correct when it is a matter of crops *in vitro*, but, in nature, protozoa and *Azotobacters* play a secondary part relatively to other living agents. Moreover this hypothesis does not explain why a particular crop e. g. lucerne, cannot be grown again on the same ground except after a certain period of repose.
- 3) *The injurious effect exercised by the organic residues left by the plant in the soil* is another suggested explanation. These residues may be either dead roots, or pellicles coming from the desquamation of the live roots. In this order of ideas, PRIANICHNIKOW and PÉRITOURINE have proved experimentally that the introduction of fragments of roots into a pot of screened soil reduces the yield. The writer has repeated this experiment under conditions permitting a more rigorous comparison. As soil is too complex a medium for it to be possible to study in it each of the factors which regulate vegetation, he preferred to make use of a sterilised nutritive liquid, in which he grew maize, following the method suggested

by MAZÉ. Three series of experiments were made :— one series grown in a liquid which had not yet borne any crop, one series in a liquid which had already borne a crop of maize, one series in a fresh liquid, but into which fragments of roots had been introduced.

The average lengths of stalk and roots showed marked increases from the 1<sup>st</sup> to the 2<sup>nd</sup> and from the 2<sup>nd</sup> to the 3<sup>rd</sup> series ; they were respectively 60 and 40 mm., 135 and 180 mm., 125 and 200 mm. It is therefore possible to conclude that, at least in the case of young plants, the presence of the dead roots of a plant is very favourable to and does not hinder growth.

4) There remains a fourth hypothesis, closely connected with the last, namely that the plant *elaborates waste products injurious* to itself, which check the development of plants of the same species, behaving like toxins. Although this hypothesis is still slightly inconsistent, it alone can explain several facts.

It is supported by WHITNEY, who quotes the following commonly observed fact : beneath the trees on a lawn there is no vegetation, and the grass disappears. This lack of vegetation is not due to shade for it would then be observed only under the north part of the tree, where the shade is more persistent ; but this is not the case, the lack of vegetation being uniform under the crown of the tree. This lack of vegetation is also not due to exhaustion of the soil by the roots of the tree, either in nutritive matter or in moisture, for, whatever amount of manure and water is given, the soil does not recover its fertility. This is therefore in all probability due to the excretion, by the leaves, of injurious substances which the rain carries down to the ground below. It must also be remembered that acid soils are infertile ; now acidity in itself, is not injurious ; in fact cultures in liquid media require an acid reaction ; nor can it be stated that acidity is injurious as checking the process of nitrification ; in fact the plant assimilates ammoniacal nitrogen as well as nitric nitrogen ; it follows that acidity is merely an indication of the presence of injurious substances.

APPLICATIONS. — This hypothesis has led to a practical application for ascertaining the nutritive value of a soil. The method recommended by WHITNEY consists of rapid comparative experiments of growth, made so as to shield the soil against the action of oxygen which would destroy the vegetable toxins, which are highly liable to oxidisation. With this object, the soil tests are made in metal pots steeped in melted paraffin ; the experiment lasts only 2 or 3 weeks ; the weights of the crops are then taken. By adding manures to the soil it can be ascertained which is the more suitable. The soil Bureau of the United States has used this method for more than 10 years ; it is not absolute, but, in practice, its results agree with those given by cultures in the field and chemical analyses do not always give such satisfactory results. It is desirable that further research should be made regarding the nature of the supposed toxic substances and the right means of destroying them. Up to the present time the use of carbon disulphide, toluen, calcium sulphide and heat have been tried empirically ; but a strict scientific study is required.

L. V.

1023 - **Irrigation in Tunisia.** — CHÉROT and CRUZET, in *Bulletin agricole de l'Algérie Tunisie Maroc*, Year XXVIII, No. 6, pp. 159-175. Algiers, June 1922.

In Tunisia, the work of the Government of the Protectorate for urban and rural water-supply and for agriculture and industry is most praiseworthy. At present there are only 135 places, with a total of 5 000 inhabitants, for which it has not been possible to provide a water supply.

The greater part of the expenditure of about 40 million francs which the Government has devoted to this work has been absorbed by the installations for carrying water to Sousse, to Sfax and to Tunis. These necessary canals are 120 km., 166 km. and 207 km. in length respectively.

The various irrigation undertakings of importance, found chiefly in the centre and south of this region have been grouped as follows for the purpose of Government assistance :—

1) Syndicates using natural spring water . . . . .	7
2)       "       " flood water . . . . .	2
3)       "       " artesian well water . . . . .	8
4)       "       " drainage water. . . . .	1
	•
Total . . . . .	18

Other similar associations are being formed.

After this preamble, the writer gives his personal opinions on the principal questions of drainage and irrigation, and suggests that in Tunisia where the greatest difficulties in the utilisation of local resources are to be found, the programme to be carried out should be —

- 1) Utilisation of permanent water courses ;
- 2)       "       " alluvial       "       "
- 3) Search for natural springs ;
- 4) Establishment of artificial sources ;
- 5) Development of underground springs and reserves ;
- 6) Drainage of marshy land and drying marshes ;
- 7) Storing water from the mountains in reservoirs ;
- 8) Scientific utilisation of natural reservoirs.

*Permanent water courses* are very scarce in Tunisia. There are however, to the south of the region numerous permanent springs which may sometimes attain a flow of 1200 litres per second.

At present all this wealth of water is more or less used by the local population for the irrigation of the neighbouring land and for motive power. On this subject, the writer gives some personal advice for the resolution of new and important problems of drainage.

**UTILISATION OF RUNNING WATER.** — As in Tunisia the hygrometrical state of the air undergoes considerable variations, sometimes a sudden change in temperature may precipitate an excessive amount of water which often causes in most of the streams actual flooding and consequently inundations of the neighbouring land which in this way are irrigated and fertilised by the mud and detritus carried by the floods.

Up to the present the natives make, at various chosen points on the streams, rudimentary irrigation works which regulate these inundations

to the best advantage. But these plants, owing to their poor construction and the power of the water flow, are easily carried away and destroyed. Consequently the writer emphasizes the necessity for constructing stable and complete plants which, while entailing heavy capital expenditure, would quickly pay their way through the increase in the local agricultural production.

**SEARCH FOR NATURAL SPRINGS.** — For this the writer advises the careful study of the geological structure of the land according to the method of Abbé PARAMELLE who, after a long practice of 25 years in 40 Departments of France, has seen his theories crowned with good results.

**ESTABLISHMENT OF ARTIFICIAL SOURCES.** — In many cases the establishment of artificial sources consists in sinking wells in the customary way, or else, when the sub-soil allows of it, and when the impervious layer is not deep, to bore a tube well.

The tube well can be sunk by NORTON'S method which consists in a steel tube driven through the impervious layer to reach the water-bearing zone, this tube being provided at one end with holes which act as a filter and at the other with a small hand pump for raising the water.

Other methods can also be used, for example those in use in Lombardy and the Northern parts of Italy for irrigating the plain of the Po. They consist of wooden cylinders driven into the ground to a depth of two or three metres through the impervious layer.

But such tube wells cannot be sunk unless the impervious layer is not thick and it is easy to reach the water-bearing stratum.

In conclusion the wells, whether sunk in the ordinary way or by the tube well method are always very useful for purposes of cultivation and irrigation and for all other human needs. Consequently the Inspectors of the Engineering Department should have experience of the means of discovering water-bearing zones so as to be able to give advice and information as to how to make use of these natural sources on request and in return for a suitable fee.

**ARTIFICIAL SOURCES.** --- Among these, in addition to the preceding, the most interesting are artesian wells. The Civil Engineering Department has constructed several in Tunisia which have given really remarkable results. Sometimes again the sub-terranean water is so arranged that after a careful study of the geological formation by means of levelling, excavation, etc. it may be made to rise to the surface level. This was done in 1918 by the Department at the Triba centre of colonisation, by excavating through strata of rocky and marble ground an approximately horizontal tunnel 150 m. long which gave access to a spring of which the minimum daily output is 500 cubic metres.

**DEVELOPING UNDERGROUND SPRINGS AND RESERVES.** — This development can be obtained by slowing down the flow of running water and thus encouraging infiltration through the soil.

This is not advisable unless the impermeable stratum is fairly shallow, since otherwise difficulties which may be insuperable will be encountered. The means which can be used to obtain the development of sub-

terranean water are many including :— earth dams, infiltration wells, etc.

But these experiments should not be made without a previous survey of the ground by opening up the soil and subsoil, levellings, soundings, etc. The writer noted, in the district of Béja, the unforeseen formation of a very large spring which arose in a badly watered property, after the clearing of a plot of ground hitherto neglected because of its want of fertility. Unintentionally the proprietor had helped to enrich the underground reserves of water with irrigation water by increasing with the clearing the coefficient of infiltration in the land.

**IMPROVEMENT OF MARSHY LAND AND DRAINAGE OF MARSHES.** — Although Tunisia is poor in water, the special conformation of the land in the Northern district is favourable to the accumulation of stagnant water and consequently of marshes, swamps, etc. The writer therefore emphasised the immediate steps to be taken for the benefit of the country by indicating the more important places where works of improvement should be carried out.

**RESERVOIRS WITH DAMS.**— The first work of this kind was constructed in Algeria between 1845 and 1849 at the mouth of the river Fig, in the plains. In the Oran district, where there is an annual rainfall of from 400 to 500 mm., there are 5 ; the Algiers district has 2 ; in the Department of Constantine, where several attempts have been made, there are none.

The writer says that after many years these works have shown their rather serious and peculiar drawbacks. Each year it is observed that the capacity of the reservoirs decreases in a marked degree. For example, the reservoir Djidionia, the initial capacity of which was about 2 200 000 cubic m. could not hold more than 200 000 cubic m. in 1912. Having ascertained this fact, the French engineers tried to lessen the mischief by getting rid of the accumulated detritus, and they did so by using the running water itself, that is to say by sacrificing a volume of water 8 to 10 times that of the mud removed.

Hence the chief difficulty which checks schemes of construction barrage and reservoir is the sense of uncertainty that the basin will not fill up so as to eliminate what are called the "aléas géologiques".

To solve this problem several commissions composed of experts have been formed. It has however not yet been possible to check the decrease in the capacity of these reservoirs under the effect of the accumulation of deposits brought down by the running water, which proves a serious disadvantage in Tunisia.

**CONDITIONS NECESSARY FOR THE SATISFACTORY USE OF RESERVOIRS WITH DAMS IN TUNISIA.** — According to the writer the best conditions will be realised if the actual volume of water from the rainfall does not exceed double the capacity of the reservoir, so that the half of the water which comes from the autumn rainfall can cleanse the reservoir, the other half, coming from the spring rainfall, only being used. For this reason :

1) A good number of probabilities which are derived *a priori* from topographical examination must be disregarded ;

2) A careful study must be made of the behaviour of the rains and the regulation of the streams of the district, which must be supplemented by geological examination, by soundings and other tests so as to ascertain the local stratification. It is only after these preliminaries that a detailed study of the scheme can properly be made.

UTILISATION OF WATER FROM BARRAGE RESERVOIRS — The greater part of this water is used both for agriculture and for town purposes.

In Tunisia the idea of replacing coal by electricity has always been popular. However as the most important consumers of electricity would be the railway and the mining companies, such substitution would be inexpedient, since the electrification of transport is not important in the country on account of the small number of trains.

NATURAL RESERVOIRS. — Up to the present these reservoirs have not been used by private industry, but they might offer certain advantages for the irrigation of cultivated land. Thus with that object the Sebka, El-Kourgiz and Garaa-El-Hamada could furnish several millions of cubic metres of water.

To sum up, little remains to be done in Tunisia as regards urban and rural water supply, but irrigation and similar schemes can make further use of local resources by utilising all the local supply, by improving and supplementing the plants which already exist with the co-operation of the local Government, which should encourage and help all good private initiative.

G. D.

1024 — **Production of Phosphoric Acid by the Method of Electric Condensation and Precipitation.** — SWANN, T, in *Industrial and Engineering Chemistry*, Vol. 14, No. 7, pp. 630-631. Washington, July 192.

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Up to the present phosphoric acid has generally been prepared by the treatment of mineral phosphates or bones with sulphuric acid. The new method by electric precipitation, is actually in use at Anniston (Alabama, U. S.), where three electric ovens are employed, which require a power of 10 000 H. P. and 44 000 volts.

This method consists in fusing in the electric oven (1) a mixture of crude phosphate, coke, sand and iron shavings. The phosphorus which by this means is set free combines partly with the iron and forms iron phosphide containing 25 % of phosphorus and part volatilises with other gases in the oven and is oxydised in the air; the phosphoric acid of 90-95 % concentration is collected in specially designed condensers, after which it is refined by special methods. The particular advantage of this process consists in the production of a highly concentrated acid which is almost free from iron, as all the iron contained in the phosphorite separates out in the form of phosphide. The acid is sent out in barrels or in transport-tanks lined on the inside with a special acid-resistant, wax compound. For pharmaceutical purposes it is necessary to recrystallise the acid, as by this means a purity of 90 % can be obtained for medicinal use or for making oxygenated water.

(1) See *R. May* 1919, No. 571. (Ed.)

This process has already been applied to the manufacture of fertilisers for which purpose a great expansion can be foreseen.

Fertilisers have already been produced containing ammonia, phosphoric acid and potash, with a fertilising power five times that of the ordinary product.

There should be some means of safeguarding the use of such a concentrated fertiliser, but the concentration will effect a great saving on freight, and it will also be possible to reduce the cost of the fertiliser. In order to fix ammonia, it will be an advantage to replace sulphuric acid by phosphoric acid and in this way to produce a fertiliser which will contain two of the three essential fertilising elements.

A. de B.

1025 - **Enriching Extract of Phosphoric Acid by means of successive Decompositions of Phosphorites.** — BOLKO, E. and SOKOLOVA, O., in *Zeitschrift für Angewandte Chemie*, Year 34, No. 88, pp. 548-550. Leipzig, Nov. 4, 1921.

There are two great difficulties in working Russian phosphorites (1), namely their small content of phosphoric acid and the great distance between their beds in the N. E. and the regions of Central Russia where they are required. Also the ordinary processes with sulphuric acid or bi-sulphate of soda do not dissolve more than 70 % of the acid contained.

The new process of Prof. PRIANICHNIKOV of Moscow, which not only makes it possible to dissolve all the phosphoric acid, but also gives a richer solution of the mineral, is therefore very important. In this method use is made as solvent not only of sulphuric acid, but also of the phosphoric acid previously extracted. To begin with sulphuric acid slightly in excess is allowed to act on the phosphorite, to which water is added in the proportion of 2 to 3 or of 2 to 4. It is mixed vigorously for half an hour and taken to the filter press. The precipitate is washed with water until it is quite free of phosphoric acid and the water used for washing is not concentrated but is used to dilute the sulphuric acid in the subsequent operations.

The following method is however perhaps preferable : — from the precipitate of the first operation two liquids from washings are obtained which are kept separate and used for washing the precipitate of a second operation. The precipitate is washed for a third time with pure water and three liquids from washings are thus obtained which are used to wash the precipitate in a third operation. This is again washed with pure water, and so on, so that each time an extra liquid from washing is obtained. The operation is repeated five times and at the end the first liquid from washing, which at the beginning contained 8 to 9 % of phosphoric acid, contains 28 % of phosphoric acid, without diminishing the quotient of purity. In fact the quantity of phosphoric acid dissolved does not depend on the quantity of acid used but only on its concentration.

A. de B.

(1) See R. Aug. 1913, No. 918. (Ed.)



- 1026 - **Experiments on the fertilising Value of "Supra" disintegrated Phosphate, in Belgium** (1). — GRAFTIAU, J., with the collaboration of GIELE, J. and HARDY, P., in *Bulletin de la Société Chimique de Belgique*, Vol. 31, pp. 22-23. Brussels, 1922.

Disintegrated phosphates are already produced in large quantities: they are obtained by calcining, in a rotary kiln, a mixture of calcareous phosphate with substances acting as a flux. The writer has tested "Supra" in pots of varnished wood fibre. Oats were the principal crop, forage cabbages the after crop. The pots were manured identically with 1.5 gm. of nitrogen in the form of nitrate of soda and 28 gm. of potash in the form of sulphate. The pots with phosphoric acid had 0.75 gm. of manure.

The writer describes in detail the course of the experiment from which he draws the following conclusions:

The test shows the high fertilising value of "Supra". The increased yields are much the same as with slag. This manure may be recommended when it is desired to use basic manures. It cannot be mixed either with manures having the power of setting free ammoniacal nitrogen or with superphosphates, exactly like slag. It is important to note that the manure should be kept dry and when spreading the workers should protect their respiratory organs.

P. C.

- 1027 - **Assimilability of various Phosphate Manures.** — VON WRANGELL, M., in *Landwirtschaftliche Jahrbücher*, Vol. LVII, No. 1, pp. 1-77. Berlin, March 1922.

For a long time the effects of various phosphates on crops in different conditions of environment has been studied at the Experimental Station of Hohenheim (Germany). At first experiments were made with various crude phosphates in the form of oolite, Norwegian crystalline fluorapatite, and of phosphates containing carbonic acid, such as carbonatapatite, staffelite and Lahn's phosphorite. The conditions and the process of absorption in two special plants, mustard and maize, were studied by examining the various chemical reactions of the liquids in the soil. Phosphates of lime soluble with difficulty (crude phosphates or pure tricalcic phosphate) were used and quite different effects were obtained in the two plants, especially regarding the ratio of absorption between the molecule of lime and that of phosphoric acid. This molecular ratio is called the "lime-phosphoric acid factor". It at once seemed probable that from this ratio it would be possible to deduce the capacity of plants for using insoluble phosphates, and to find some explanation regarding the manner in which assimilation of phosphoric acid is caused.

The numerous experiments made show this theoretical supposition to be correct, and this factor may possess great importance. By examining the value of this factor in various plants it is found that the phosphates of lime are not well absorbed by cereals, especially by wheat, rye and barley (1.3); slightly better by oats (1.6) and by maize (3). The potato comes next, then leguminous plants such as beans, peas; clover absorbs well (12), turnips, sugar beet, mangolds and hemp absorb very well (23), tobacco and mustard also well (15). In the recent work of PFEIFFER and

(1) See R. May 1919, No. 572. (Ed.)

RIPPEL, "Behaviour of various plants under the action of phosphates soluble with difficulty" (*Journal für Landwirtschaft*, LXIX, p. 165), in which the "lime-phosphoric acid" factor is calculated, the important discovery is given prominence that with a progressively intensive manuring with phosphoric acid the "lime-phosphoric acid" factor decreases regularly.

The reaction of the soil has very great importance for the rate and degree of absorption of phosphoric acid; the acid reaction facilitates and increases its absorption. The absorption of phosphoric acid by a plant which grows in an acid soil is very great: on the other hand the alkaline reaction increases the absorption of lime. Special experiments made with oats and maize by applying to excess alkaline manuring (with silicate of potassium, nitrate of potassium, nitrate of ammonia and gypsum) and acid manuring (with sulphate of ammonia and sulphate of potassium) have plainly proved that the "lime-phosphoric acid" factor undergoes great variations. To ascertain to what extent plants withstand an acid or alkaline manuring, special experiments were made in cement boxes, made waterproof with a layer of paraffin, in which the reaction of the soil could be quantitatively controlled. In the case of maize the results were such that poisoning by alkaline reaction might be inferred whereas mustard consumed the insoluble phosphates even in the case of alkaline nitrogenous manuring. These experiments also prove a remarkable sensitiveness of mustard to chlorine. In fact the chloride of ammonia produces toxic effects on that plant. Further experiments are in progress in order to ascertain the function of chlorine. During growth a bright green coloration of the soil was also noticed, which may perhaps be explained by the presence of micro-organisms previously studied by REICHNOW, WOLLENWEBER, KNOP and LÖW. Growth was afterwards affected by some infection, as happened in the case of some experiments of comparative manuring with oolite and with carbonate of lime. Experiments were then made to determine what amount of lime is required to prevent the absorption of phosphoric acid. Some plants showed evidence of attempts to eliminate from their circulation the excess of lime which prevented that absorption: for example endogenetical production of oxalic acid, as the writer suggested in a previous work and as the researches of STALK confirm. To control the process sand was neutralised by a special treatment invented by the writer for cultures, by depriving them of all the carbonate of lime present. The sand was next manured and for each molecule of tricalcic phosphate 1 — 2 — 5 — 9 — 20 — 75 — 225 — 675 molecules of carbonate of lime were added progressively and respectively for each culture. Oats did well in the absence of carbonate of lime; the yield diminished by one half with one molecule of carbonate, by one third with two molecules; it was almost nil with larger quantities. On the other hand, maize continued to prosper in a satisfactory manner even with 5 — 9 — 20 molecules of carbonate.

Although in a less degree, the action of tricalcic phosphate can be noticed even in the presence of 225 and 675 molecules. The writer asserts that, the conditions of the soil being identical, there will never be an equal

reaction under the influence of tricalcic phosphate for two plants physiologically different. If plants of mustard and maize are grown in neutral soil to which has been added tricalcic phosphate the nutritive functions will be disturbed and the mustard will die for lack of lime and the maize for want of phosphoric acid, as can be proved by analysis of the ash. The writer attributes the greatest importance to the analysis of the ash. The researches of KRÜGER, EMMERLING and the recent experiments prove therefore that some plant species, although not all, utilise tricalcic phosphate in a satisfactory manner, even in the presence of lime.

The susceptibility of lupines with regard to lime, has been known for many years and has formed the subject of many publications, but hitherto with no definite result. On this subject the researches of PREIFFER, CREYDT, WALTER MEVIUS, KAPPEN, MERKENSCHLAGER, SCHULTZ-LUPITZ and other writers are worth noting; the experiments of BÜSGEN, according to the author, are contradictory. The writer thinks that the injuries caused by lime in lupines result from disturbances in the nutritive functions; easily soluble or physiologically alkaline salts of lime, such as the nitrate and carbonate especially, might, by their presence, prevent the absorption of phosphoric acid. This hypothesis, already expressed by the writer in a previous work, was recently confirmed conclusively.

The preceding observations lead to the establishment of a constant law of polarity between lime and phosphoric acid. Thus it has been ascertained that with manurings of phosphates of lime the absorption of phosphoric acid is very limited. The data of EMMERLING vary between 4 and 17 %, according to the nature of the soil. In experimental stations 30 % is not exceeded. The writer made experiments with tertiary phosphates of iron, aluminium and magnesium. Contrary to the general opinion, the results obtained with the first two were good and those with phosphate of magnesium were remarkable. The methods of manuring employed up to the present are therefore too exclusive in the sense that only phosphates of lime have been considered. The recent experiments have shown that, where the plant does not require lime, the other compounds of phosphoric acid should always be preferred. Regarding the specific case of phospho-magnesian manuring, the writer examines the two processes of assimilation which take place in the plant, namely that of absorption at the expense of ionic soil solutions and that of direct total absorption, without basic residue, of particles of phosphate of magnesium.

The writer next examines and controverts the theory of LOEW, according to which the two substances, calcium and magnesium, should be furnished to plants in a certain relative proportion in order that the best results should be obtained. The writer maintains on the contrary that the form of combination of the two elements is much more important than the quantitative proportion; for example, carbonate of magnesium is injurious, while the sulphate is favourable to growth. EHRENBURG'S law on the lime-potash stoichiometrical ratios, according to which the presence of lime prevents absorption of potash, enters this field of research, the numerical results of which do not always seem reliable.

The practical importance of this subject is worth consideration. In the first place it has been proved that the choice of the base in phosphoric compounds is far from being negligible.

The phosphate "Rhénania" and basic slag, the composition of which is still uncertain, have no great importance. More interesting is the problem whether nitrogen or phosphorus should be preferred. In LIEBIG'S time, mineral phosphates were undoubtedly preferred, but it is possible that since then the soils have changed under the action of a continued mineral manuring. At the present time it is incontestable that nitrogen gives better results than phosphoric acid. Furthermore the quite special conditions of Germany at present must be considered: nitrogenous manuring was already in deficit in many lands before the war, because of its high cost: the soils are on the average more sensitive to nitrogen than to phosphoric acid; then from an economical and national standpoint, nitrogen and potash are produced by German industry, while phosphates have to be imported from abroad. In conclusion the use of other compounds of phosphoric acid in replacement of those hitherto used as artificial manures seems to allow a good result by making possible the disposal of reserves of phosphoric acid. The writer next describes the experimental part of his researches, analysing in detail and chronologically the results given by each experiment, considering in a special way the conditions of soil, irrigation and the manuring.

The description of the experiments is supplemented by 23 large tables in which are grouped the numerical data relative to them, and by 2 photographic plates.

A. d. B.

1028 - **The Supply of Nitrogen for Agriculture in Germany.** -- *Wirtschaft und Statistik*, Year 11, No. 3, pp. 72-73, 2 figs Berlin, Feb. 1922

From 1913 to 1922 the German production of nitrogen has been the following:—

1913/14 . . . . .	110 000 tons	1920/21 . . . . .	242 000 tons
1918/19 . . . . .	115 000 »	1921/22 . . . . .	290 000 »
1919/20 . . . . .	159 000 »		

Half the production consists of sulphate of ammonia and the other half of nitrate and cyanamide of calcium.

TABLE I. — *Quantities (in tons) of fertilising matter consumed in German agriculture from 1913 to 1920.*

Year of manuring	Nitrogen	Phosphoric acid	Potash
1913. . . . .	210 000	630 000	557 000
1918. . . . .	115 500	231 000	670 000
1919. . . . .	159 200	137 800	756 000
1920. . . . .	212 000	268 000	578 000

The figures in Table I are represented graphically (in thousands of tons) in the annexed diagram.

For the year 1921-22 the use of 290 000 tons of nitrogen is estimated and it is expected that the whole of this amount can be supplied by national production. Besides artificial fertilisers must also be reckoned food stuffs, the residues of which (farmyard manure) supply the soil with nutritive principles. This is shown in Table II.

TABLE II. — *Differences in the use of various manures in time of peace and in time of war (in tons)*

Products	1913 Excess of imports (+ = excess of exports)	1920 Excess of imports (+ = excess of exports)
Cattle foods . . . . .	6 282 000	540 000
Crude feeding matter . . . . .	1 734 000	329 000
Manures :		
Crude phosphates . . . . .	297 000	116 000
Nitrogenous manures . . . . .	710 000	(+ 14 000)
Organic manures . . . . .	99 000	1 000
Potash salts . . . . .	(+ 1 676 000)	(+ 843 000)

TABLE III. — *Yields per hectare of the principal crops, in qrs.*

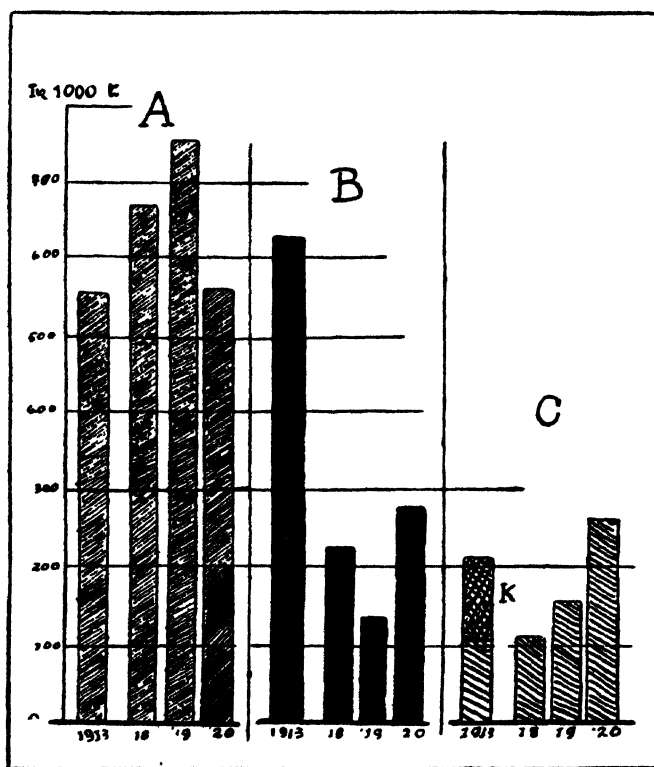
Products	1913	Average of the years 1904-1913	1921
Rye . . . . .	19.2	17.2	15.9
Wheat . . . . .	24.1	20.7	20.4
Barley . . . . .	22.0	19.8	17.1
Oats . . . . .	22.0	19.0	15.1
Potatoes . . . . .	157.1	135.1	98.8
Sugar beet . . . . .	—	287.8	204.9
Hay . . . . .	49.1	43.0	31.5

TABLE IV. — *Price obtained for nitrogen (in marks per kg.)*

Date	Sulphate of ammonia	Nitrate of Soda	Cyanamide of Calcium
1914 . . . . .	1.35	1.40	1.15
11 January 1916 . . . . .	1.48	—	1.74
13 March 1919 . . . . .	2.60	3.55	2.40
1 October 1919 . . . . .	5.40	6.50	5.40
1 March 1920 . . . . .	12.00	15.00	10.70
1 June 1921 . . . . .	14.50	17.50	12.90
7 October 1921 . . . . .	17.40	24.00	15.50
3 December 1921 . . . . .	25.80	31.20	23.00
<i>Increase in price at the end of 1921 (in proportion to the pre-war price equal to 1)</i>	19.1	22.3	20.0

The cessation of the importation of Chili saltpetre and the great decrease in the importation of cattle foods and crude feeding matter are of special importance. Concentrated foods admittedly supply annually 100 000 tons of nitrogen to German agriculture. The effect of the decrease in manuring is shown by the decreased yield per hectare of the principal crops (see Table III page 1203).

*Diagram representing the quantities (in thousands of tons) of fertilising matter consumed in German agriculture from 1913 to 1920.*



EXPLANATION :

- A = Potash ( $K_2O$ )
- B = Phosphoric acid ( $P_2O_5$ )
- C = Nitrogen (N)
- K = Nitrogen contained in Chili saltpetre.

The value of the nitrogen estimated to be used for the year 1921-22, according to the present price, is 7 milliards of marks. Taking the dollar at 180 marks, Chili saltpetre costs double the price of nitrate of soda produced in Germany.

A. d. B.

1029 - **Fixation of Atmospheric Nitrogen, and the Fabrication of Nitrogenous Manures in Egypt.** — HUGHES, F., in *Ministry of Agriculture, Egypt. Technical and Scientific Series, Bulletin No. 20*. Cairo, 1922.

After a general survey of the question of the fixation of atmospheric nitrogen, the author deals more especially with the problem of nitrogenous manures in Egypt in relation to soil conditions.

Before the war, Egypt spent some £15,600,000 annually on fertilisers, chiefly nitrate of soda and sulphate of ammonia. So far experiments have not been worked out to any large extent for Egyptian soils, but it may be concluded *a priori* that nitrate of lime is more useful than nitrate of soda. One of the chief drawbacks in Egyptian farming is the presence in the soil of small quantities of sodium salts, usually chloride, sulphate and bicarbonate and rarely carbonate, which is the most troublesome of all. Now as sodium is not one of the essential elements for plant growth the nitrogen from the nitrate of soda may be taken up in the form of nitrate of potash or nitrate of lime and the soda residuum will increase the amount of salts already present in the soil.

Pot experiments have been made with soil from the Nile bank to which various manures were added. Nitrate of lime proved the most effective. Taking the increase brought about by nitrate of soda (average) as 100 the following results are obtained for other fertilisers:— nitrate of lime 104; sulphate of ammonia 92; nitrate of ammonia 98; cyanamide 59. The slowness of the action of organic manures appears to be due to a failure to change the latter to nitrate, but the shortness of the time factor is no doubt of importance in this connection.

As regards the industrial aspect of the question the author states that at Assouan power is available of well over 250,000 HP which would serve to supply some 750,000 tons of nitrate of lime for six months, that is, more than the pre-war demand of the country.

Transport costs are very high in Egypt and hence the preference for concentrated fertilisers such as urea, superphosphates with 40% phosphoric acid content etc.

On the assumption that 100,000 tons of fertilisers were utilized annually, the increased wheat production is estimated at 6 million bushels (17%), which would give a total crop amounting to about 35 millions bushels.

A. d. B.

1030 - **Fertilisers for Beans.** — See No. 1050 of this *Review*.

1031 - **Seeds and Plants introduced by the Agricultural Department of the United States.** — *Inventory of Seeds and Plants imported by the Office of Foreign Seed and Plant Introduction during the Periods from: January 1 to March 31, 1917; April 1 to June 30, 1917, July 1 to September 1917; No. 30, 83 pp.; No. 51, 100 pp.; No. 52, 55 pp.* Washington, 1922.

In the first three parts of the inventory of imported plants (which also gives the places where the plants were collected, their description, and the uses to which they could be applied, etc.), FAIRCHILD, Agricultural Explorer in charge, mentions the following:

AGRICULTURAL  
BOTANY,  
CHEMISTRY  
AND  
PHYSIOLOGY  
OF PLANTS

**CEREALS.** — A variety of maize (*Zea Mays*) with bitter leaves coming from Rosario (Argentina). Although its yield is somewhat low, and it is liable to attack from grasshoppers, this species of maize can be cultivated advantageously in districts infested with these insects which only eat its leaves when there is absolutely nothing else to be found, as they dislike the bitter taste. This maize could perhaps be employed in crossing experiments undertaken with the view of obtaining forms resistant to disease and to insect attack.

**FORAGE PLANTS.** — Tussock Grass (*Poa flabellata*) a native of the Falkland Isles, where it grows on the peaty soil near the sea. It makes a good forage and the roots are edible and have a pleasant flavour.

Four forage Gramineae known as "Satintop" viz., *Andropogon erianthoides*, *A. intermedius*, *Chaetochloa barbata* and *Panicum decompositum*, imported from New South Wales are noted for their hardiness and heavy yield.

A collection of 11 species of *Poa* from the Belgian Congo sent by the Leverville Agrostological Garden.

*Panicum serratum* giving pasturage for sheep at an altitude of 2000 m. near Pretoria (South Africa) is worth trying on the mountain pastures of the Pacific slopes.

Meadow rice grass (*Microlaena stipoides*) from Australia and New Zealand, where it carries large numbers of stock, also merits a trial.

Three selected kinds of Red Clover (*Trifolium pratense*), sent by the Royal Danish Agricultural Society: Tystofte No. 71, early; Tystofte No. 87, late; Hersnap late; the last is the best, and is already grown on a large scale in Denmark.

**KITCHEN GARDEN PLANTS.** — A wild tomato from Cristobal (Panama Canal region), *Lycopersicon esculentum* resistant to wilt (*Bacillus Solanacearum*).

Manhattan melon (*Citrullus vulgaris*) from Natal.

The fruits can be kept for 6 months; they are much used in South Africa for preserves and are very suitable for this purpose owing to their thick rind which has a high pectin content.

*Allium triquetrum*, the form bred by TRABUT with very delicately flavoured bulbs.

Pepino (*Solanum muricatum*) from Ecuador, where there are two varieties, one white and the other red, that produce almost seedless fruits making excellent salad.

*Gnetum gnemon* from the Botanic Garden of Buitenzorg (Java), a shrub growing from the Khasi Mts (British India) to Singapore. It has edible fruits, the leaves can be eaten like spinach and the bark furnishes a stout fibre.

Lorocco vine, an undetermined Apocynaea coming from Tegucicalpa, Honduras. It is a perennial climber with deciduous leaves and thrives in temperate climates: the flowers and floral buds are used as a condiment.

A collection of excellent varieties of "pai t'sai" (*Brassica pechi-*



*nensis*), collected in the Provinces of Shantung and Hankow (China). Some kinds can be sown in April-May, August, and September.

ORNAMENTAL PLANTS. — Several strong, beautiful species of *Cotoneaster* suitable for flower gardens. Species of *Cotoneaster* are widely grown in England, but the English forms when introduced into the United States proved too delicate to be generally cultivated.

From Guatemala have been imported : the Monkey-flower tree (*Phyllocarpus septentrionalis*), which bears brilliant red flowers in January — *Lignum vitae* (*Guaiacum guatemalense*), an ever-green shrub with conspicuous purple flowers ; this plant was already grown in Florida. — *Salvia Hempssteadiana*, with fine clusters of blue flowers ; could be used as a substitute for *S. patens*, a handsome, but delicate plant.

"Pacayito" (*Chamaedorea* sp.), one of the few dwarf palms that can be grown in small pots in dwelling-rooms.

A collection of *Berberis* has been obtained from Columbia, Chili, Tierra del Fuego (Argentina), the Caucasus, Himalaya, Thibet and China. All the varieties are very hardy ; some are evergreen, some bear edible fruits while others are seedless. An evergreen type producing large seedless fruits suitable for jelly-making could easily be obtained by crossing the various types.

A collection of different species of *Styrax* purchased by a Paris firm.

*Ficus pseudopalma* from Corregidor (Philippines), with a crown of leaves which are about 1 m. in length.

*Casuarina stricta* and *C. Cunninghamiana* natives of Australia. It is hoped that they will prove hardier than *C. equisetifolia* which grows in millions on the road-sides of South Florida.

"Kadoesji" (*Cephalocereus sanguinosus*), a cactus with fine edible fruits.

*Butia capitata* (1) a hardy palm bearing eatable fruit. A native of Argentina.

PLANTS YIELDING OILS, TANNINS AND GUMS. — "Olivo tafahi" (*Olea europaea*), a native of the Fayum desert (Egypt). It owes its name, which signifies apple-olive, to the unusual size of the fruits ; these are 4.5 cm. in length and have a short diameter of 3 cm.

Soft lumbang tree (*Aleurites trisperma*) yields a drying-oil similar to the "tung oil" of China (2)

*Tamarix aphylla* ; the seeds were sent from Algiers by TRABUT. The plant is a native of the Sahara. A mite, *Eriophyes tlaiae* produces on the leaves galls containing 45 % of pyrogallin tannin largely used for tanning purposes by the natives. This plant, which has been tested in the Coachella Valley (United States), has grown to a greater size than any other arborescent species, the girth of shrubs aged 2 ½ years is 90 cm. at 30 cm. from the ground.

(1) See R. July 1921, No. 716. (Ed.)

(2) See R. February 1920, No. 254. (Ed.)

Two African gum acacias from Khartoum (Sudan) *Acacia albida* and *A. Segal* (1).

VARIOUS PLANTS. — A species of *Amaranthus* (*A. paniculatus*) from Cashmere with farinaceous seeds forming the staple food of the mountain tribes of several parts of India. In these regions, the plant is called "raiigira".

The "Pacaya palm" (*Chamaedorea* sp.) of Guatemala, where it is much grown for its inflorescences which are eaten as salad.

*Calycophyllum brevipes*, a Venezuelan *Cucurbitacea* with orange-yellow fruits having a sweet pulp and containing (perhaps in the loculi or seeds) a substance more pungent than is found in the capsicum. It is called "parcha de culetra" or the serpent's passionflower. Perhaps it is the "coco de mono" to which is attributed depilatory properties.

Kafir orange (*Strychnos spinosa*), a Loganiaceae from British East Africa imported from Nairobi. The inner part of the bark of this shrub appears to be an antidote to snake-bites. The fruit is edible and resembles an orange: *Strychnos spinosa* grows well in South Florida.

Seeds of *Bambostulda* from Dehra Dun, India. This species is easily cultivated in Panama and at Porto Rico. Its stems make excellent fishingrods.

*Cudrania* (*Machera*) *tricuspidata* (2) a Moraceae that has become acclimatized at Augusta, Georgia (United States) and gives a heavy yield. Silkworms fed on the leaves of this tree produce a silk different from the silk obtained from silkworms fed on mulberry leaves, and better-toned strings for musical instruments can be made from it. As silk is a typical protein, any change in its characters may be of importance for the study of alterations in other proteins.

A new annual Leguminosae (*Aeschynomene* sp.) for green manure. This plant is very well provided with root-nodules and could perhaps be used as a forage plant. It comes from Costa Rica.

Two Rubiaceae sent from Buitenzorg (Java): *Pavetta indica* and *Psychotria bacteriophila*; the latter has also been brought from the Comoro Islands, Madagascar, where it is indigenous: the first named grows throughout India and Malaysia. Both these plants are remarkable for their leaf nodules which resemble the root nodules of leguminosae and, like them, possess the power of fixing atmospheric nitrogen. Their capacity in this respect will be tested in Florida.

VINES. — *Vitis tiliacifolia*, a native of Guatemala, where its fruit is much used for making jellies. It grows well in South Florida, and would make a good stock for American and European vines.

"Callulos" (*Vitis* sp.), from the Mexican valleys; the berries are large and do not fall off when ripe, as in the case of most tropical vines. It is therefore suited to tropical countries and can be cultivated in Florida.

FRUIT TREES, SHRUBS AND BUSHES. — A collection of new varieties

(1) See R. 1921, Nos. 292 and 630. (Ed.)

(2) See R. March 1916, No. 338. (Ed.)

of apple trees raised from seed and sent by the Central Experimental Farm, Ottawa (Canada). Five of them belonging to the Wealthy variety are remarkable for hardiness, resistance to cold and the the flavour of their fruit.

Sixteen different species or hybrids, of the genus *Pyrus* (*P. amygdali-formis* — *P. betulaeifolia* — *P. Bretschneideri* — *P. Calleryana* — *P. phaeocarpa globosa* — *P. heterophylla* — *P. Korshinskyi* — *P. malifolia* — *P. Michauxii* — *P. oblongifolia* — *P. ussuriensis* Maxim — *P. ussuriensis ovoidea* Rehder — *P. Pashia* — *P. salicifolia* — *P. serotina* — *P. serrulata*) are worth trying as stocks for grafting. This is a matter of special interest at the present time as an effort is being made to eliminate all European fruit trees as stocks and to substitute for them trees with a more uniform root system.

Several collections of species and varieties of pear tree from the Province of Chihli (China) amongst which are the "pai li" and other cultivated varieties of *Pyrus ussuriensis* with edible fruit; another pear-tree possibly new to science and used as a stock by Chinese fruit-growers; cultivated varieties of *P. Lindleyi* etc. The cultivated varieties of *P. ussuriensis* and *P. Lindleyi* that are resistant to the blight or necrosis of the branches of the apple and pear-tree (*Bacillus amylovorus* [Burril] Trev) may prove of great value in crossing experiments aiming at producing forms that are resistant to this parasite.

The nearly-related genus *Docynia*, of which the species *D. Delavayi* has been imported from West Szechwan and the Yunnan, may also prove useful in the same direction. The lastnamed is also a very vigorous stock for grafting.

Collections of Chinese varieties of peach (*Amygdalus* spp.) from the Province of Kiangsu (China).

"Yacarati-à" or "papaya" (*Carica dodecaphylla*), indigenous in the Provinces of Misiones and Carrantes (Argentina), has been the object of interesting comparative trials with *C. Papaya*, and of crossing experiments. Crosses have already been obtained between *C. caudamarcensis* and *C. Papaya*.

Seeds of *Castanea mollissima* from Nankin (China) useful in crossing for the purpose of obtaining orchard chestnut-trees resistant to bark disease (*Endothia parasitica*).

Seeds of *Castanopsis sclerophylla* from Nankin probably useful for the same purpose.

*Ziziphus mauritiana*, cultivated in India (the best varieties being grown at Kandahar); its fruits are eaten fresh or dried. *Z. mucronata* from Kandahar. These tropical species are to be added to the already rich collection of varieties of *Ziziphus* with large and delicious fruits which have already been introduced from China into the United States where they are grafted on the common varieties and will soon be generally cultivated.

The Kansu virburnum (*V. kansuense*), of which the fruit is employed in preserve-making, could perhaps be used for the improvement of the native North American species (*V. americanum*).

From Canada, France, England, Italy and Java, several collections of red, black and yellow currants have been imported. Currants are little grown in the United States, but would probably do well in the Northern States of the Union.

*Rubus racemosus* from the Nilgin Mts. (British India).

Several collections of avocado (*Persea americana*), made in Guatemala by POPENHOE, and containing the following varieties: "panchoy", early — "benik", midseason — "tumin", exceptionally prolific — "kekci", early with small fruits that ripen slowly — "mayapan", one of the best in the collection, in the opinion of POPENHOE — "cabual" with special hazel-nut flavour — "candel" a very small seeded variety — "pankay" found at the altitude of 1500 m. (i. e. higher than for tropical countries) — "tertoh" bearing fruits that weigh 1800 gm. — a hitherto undescribed kind of *Persea* with fleshy persistent calix — "coyo", or "schukte" (*Persea Schiedeana*) a very rare species, also collected by POPENHOE in Guatemala, which is worth introducing into all tropical countries. This plant in the wild state bears fruit which are as good for the table as those produced by *P. americana*; it does not seem to be cultivated in any of the Botanical Gardens of the world. One form has a fine fruit weighing about 2 lb.

Other fruit-bearing species collected by POPENHOE in Guatemala are: the Tortoise-shell custard-apple (*Anona testudinea*), with rather tough-skinned fruits containing large seeds and with pulp free of stone-cells — "cereza", or "capul", the mountain wild cherry-tree (*Prunus salicifolia*), bearing bunches of large fruits (some 18 mm. in diameter) and with a taste similar to that of the ordinary cherry etc.

*Mangifera caesia*, resembling the mango, worth testing as a grafting stock and in crossing experiments.

*Garcinia multiflora* of Kiayingchow, near Swatow (China) produces small fruits of delicious flavour resembling that of the mangostan. As this tree can resist a temperature of  $-3^{\circ}\text{C}$  it could probably be grown in other than tropical countries, while its similarity to the true mangostan might render it useful in selection work.

A hitherto undescribed species of *Rollinia* coming from the valleys of North Columbia, and bearing edible fruit with orange-coloured skin and pulp, and the biribâ (*Rollinia mucosa*), imported from Brazil, form another group of Anonaceae to be added to the collection that is being made for crossing experiments at Miami, Florida.

"Cuatemoya", a hybrid between the "atemoya" (*Anona cherimola*  $\times$  *A. squamosa*) which produces delicious fruit, and the "custard apple", or basket anona (*A. reticulata*), have been obtained by WESTER from the Lamas Experiment Station (Philippines).

Guabioba (*Compomanesia Fenzliana*), a native of Lavras (Minas Geraes, Brazil), a Myrtacea with delicious flavour similar to that of the guava. In the Plant Introduction Garden of Miami, Florida, it has proved resistant to frosts and would probably bear excellent fruit wherever it was cultivated. *Nephelium bassacense* from Cochin China comparable to *N. lappaceum* from Java, which produces a delicious fruit.

*Litoco* (*Calamus* sp.), from Kaingan (Luçon du Nord, Philippines), with bunches of small, slightly acid fruits with a pleasant taste and keeping well.

Tree tomato (*Cyphomandra betacea*), a Solanacea cultivated for its fruit in British East Africa.

FOREST TREES. — A new species of *Picea* (*P. Meyeri*), of large size coming from Shing-hung-sham, in the province of Chihli (China).

Ash from Chinese Turkestan (*Fraxinus potamophila*). This species proved perfectly resistant at Fallon (Nevada), and will be a valuable tree for the poor land of the district.

A black, tropical walnut from Porto-Rico (*Juglans portoricensis*) which attains the height of 20-25 m. and produces fruits 3-5 cm. in length. Useful for the proposed hybridisation trials with the object of obtaining quickly-growing timber walnut trees.

*Prunus serrulata sachalinensis*, which is probably the best wood-producing cherry-tree. It grows to the height of 20 m. Several varieties of a collection of cherry-trees imported from Japan have shown every sign of possible acclimatisation on the Atlantic sea-board of the United States.

"Tzu" (*Catalpa Bungei*), imported from Chekiang (China), a tree of rapid growth. It attains the height of 30 m. and furnishes a very valuable wood for the fancy turnery trade. Much recommended for planting along the ditches and irrigation canals of the semi-arid regions of the United States.

F. D.

1032 — **New and Noteworthy Philippine Plants** (1). — MERRILL, F. D. (Director and Botanist, Bureau of Science, Manila), in *The Philippine Journal of Science*, Vol. 20, No. 4, pp. 367-476 Manila, April 1922

The 17th of a series of studies published by the author. In the present paper 106 new species are described. Amongst these is included a further description of *Ficus argentea* Blanco, previously known only from BLANCO'S imperfect description. *Polychroa* Loureiro is accepted as the proper generic name for the group long known as *Pellonia* Gandichaud. The few Philippine forms formerly placed in *Polytrema* are now transferred to *Hallieracantha*. Three genera are reported for the first time viz. *Pyrenaria*, *Pleiocarpidia* and *Cowiea*, the latter a recently described genus, previously known by a single species in British North Borneo. A few notes on nomenclature are included, which involve some changes in specific names.

L. V.

1033 — **Nickel and Cobalt in living Organisms.** VERNADSKY, W. J., in *Comptes rendus de l'Académie des Sciences*, Vol. 175, No. 8, p. 382-285 Paris, Aug. 21, 1922

Nickel and cobalt belong by geochemical reactions, by the primary and partly secondary minerals and by their behaviour in the organisms, to the *isomorphous series of magnesium*. The elements which form this series give rise to similar chemical phenomena and to compounds which have similar functions in both the inorganic and organic spheres.

(1) See R. July 1922, No. 697. (Ed.)

In biochemistry, five elements of the series, iron, copper, manganese magnesium and zinc perform similar functions and replace each other. They form an integral part in many complex proteinic pigments which are fundamental in the physiological processes of the animal and vegetable kingdoms :— chlorophyll, hemoglobin, hemocyanin, hemosycotypin, pin-naglobin, etc. Certain physiological phenomena suggest the same chemical facts. It is to be inferred that other elements of the group will also show similar behaviour. These elements are *nickel*, *cobalt*, *cadmium* and possibly also *indium*. The last two have not yet been found in living organisms.

In 1854, J. FORCHHAMMER recognised the presence of nickel and cobalt in marine algae and in the ash of oak ; they have also been casually noted, but hitherto there has been no systematic experimentation.

In these conditions the writer in 1918-19 started experiments at Kief with the co-operation of the Academy of Sciences of the Ukraine, but difficulties were caused by the civil war. However the two elements were found in all the organisms on which experiment was made with L. TSCHOU-GAJEFF'S reagent. In plants, the presence of nickel and cobalt can be determined quantitatively.

The presence of nickel and cobalt was recognised in all the mosses examined from the neighbourhood of Kief. M<sup>me</sup> M. J. BEZSMERTNY, the writer's assistant, found them in the following plants in the district :— *Plantago media* — *Ficaria ranunculoides* — *Salix pratensis* — *Taraxacum officinale* — *Avena pubescens* — *Lamium purpureum* — *Capsella Bursa-pastoris* — *Stratiotes aloides* — *Lysimachia thyrsoflora*. Prof. W. SADIKOV, of the Radium Institute at the Russian Academy of Sciences at Petrograd, found cobalt in *Echium vulgare* L. at Salgnirka, Crimea.

The experiments made by M<sup>me</sup> I. C. STARYNKEWITCH have disclosed the presence of traces of nickel in house mice. L. V.

1034 — Chemical analysis of the Gramineae, *Panicum Maximum*, *P. jumentorum* and *P. barbinode*. — See No. 1053 of this Review.

1035 — Action of soluble Salts of Lead on Plants. — BONNET, F., in *Comptes rendus de l'Académie des Sciences*, Vol. 174, No 7, pp. 488-491. Paris, Feb. 12, 1922.

With the object of determining the action of soluble salts of lead, numerous tests were made in 1914 on Bordeaux wheat, buckwheat, lupin, lentil, cabbage, etc. The seeds, disinfected in alcohol, were set to germinate in distilled water, and the young plants were placed in solutions of various salts of lead of different degrees of strength. The results were as follows :—

1) The plants subjected to a strong dose of salt (decinormal solutions) absorbed the lead, which was only found again in the bark of the roots.

2) The lead taken out of the solutions was found in its entirety in the ash of the roots of the plant tested, and no traces were found in the ashes of the stalks and leaves.

3) Decinormal solutions of acetate or nitrate of lead are toxic for wheat (killed in 20 days), buckwheat (in 7 days), lupin (in 4 days),

balsamine (in 2 days), lentils (in 1 day) and cabbage. At the strengths used, the salts of potassium, magnesium and calcium did not appear to be antidotes of the lead.

4) Acetate and nitrate of lead gave identical results with wheat and cress. The younger the plant when subjected to the test, the more sensitive is it to the poison.

5) The more concentrated the solution of the salt, the more active is its absorption.

6) The transpiration of plants subjected to the action of lead was markedly decreased in comparison with plants which were grown in pure water.

Further experiments made by the writer in 1921 have fully confirmed these results. They have further shown that the salts of lead cause important modifications in the external morphology of the roots. In pure water roots are long and much branched, thin and unfurnished with absorbent hairs; in solutions of lead they are, on the contrary, short, thick and provided with numerous absorbent hairs. When the growth of the stalk is arrested by the lead salts, the growth of the roots is continued, though more slowly, in the same proportions as in normal conditions.

A. d. B.

1036 - **The Role of Manganese in Plants.** — MC HARGUE, J. S., in *The Journal of the American Chemical Society*, Vol. 44, No. 7, pp. 1592-1598. Washington, July 1922

The presence of manganese in the soil and in the ash of plants was first detected by SCHEELÉ in 1774, but during the nineteenth century few researches were made as to the function of this element. Mention should be made of the work of BERTRAND (1897) and of BRENCLEY (1914) who concluded that manganese is an element essential to the economy of plant life. During the last 20 years, considerable attention has been given to the agricultural problem of manganese and the author knows of as many as 150 investigations on the subject.

While engaged on botanical research work necessitating a test for manganese, the author found that the latter is present in the seeds of many plants, and especially in the seed-coats, the integument of wheat containing approximately 0.02 % of its dry weight of manganese. This induced him to make investigations for the purpose of determining the functions of manganese by growing seedlings in PFEIFFER'S nutrient solution after carefully removing all trace of manganese from the compounds used in its preparation. This precaution was necessary as in previous experiments the calcium, magnesium and iron salts used as plant nutrients were found to have contained the small percentage of manganese required by the seedlings. Several lots of wheat were grown, some with and others without manganese. No difference between them was noticed for the first 6 or 8 weeks, but a little later the plants deprived of manganese behaved very differently from the others; their leaves, owing to lack of chlorophyll, became yellowish-green instead of deep green. The differences between the two sets of plants increased as they approached maturity,

those without manganese made a stunted growth and produced no seed. The dry weight of the plants given manganese exceeded by 135 % that of those deprived the element.

Other experiments were made with Alaska peas with very similar results. When analysed, the plants that had received manganese were found to contain 0.179 % of this element, whereas those to which no manganese had been added showed only traces derived probably from the seeds. The importance of manganese to plant development was also proved by growing several different species on sand ; at the present time, there are 20 different series of experiments in progress on the subject.

It may be assumed that the small quantity of manganese always present in the seed is sufficient to maintain a normal metabolic process during the first few weeks of growth ; afterwards the manganese is used up in the formation of new tissues and plants that do not receive a further supply of this necessary element become chlorotic. The first change to be noted is a lack in the development of chlorophyll in the lately formed tissues and the growing parts ; finally the tips of the branches die back, and the plant almost ceases to develop further.

It appears that leguminous plants are more sensitive to want of manganese than non-legumes ; this suggests that the element is concerned in nitrogen assimilation and the synthesis of proteins. Manganese apparently plays the part of a necessary catalyst in plant metabolism, and together with iron, functions in the synthesis of chlorophyll. A. de B.

1037 - **Influence of Lime on Germination.** — MAQUENNE, L. and CERIGHELLI, R., in *Comptes rendus de l'Académie des Sciences*, Vol. 171, No. 20, pp. 1270-1272. Paris, May 15, 1922.

MAQUENNE in collaboration with DEMOUSSY, has shown that lime is indispensable to germination ; even in very small quantities it triples the length of the roots of peas in 6 days when compared with pure water cultures (1).

The writers have examined the question again and made weight, tests independently of tests by length, and extended their experiments to various kinds of seeds, namely : peas, wheat, lentil, cabbage, cabbage lettuce, radish, buckwheat and maize. The seeds were washed in sterilised water for 24 hours and the maize seeds were sterilised with a 2 per 1000 solution of sublimate. They were then made to germinate in sand soaked in pure distilled water. After 2 or 3 days they were treated partly with pure distilled water and partly with a 1 millionth solution of sulphate of lime in very weak proportions, similar to those obtained by heating pure water in a burnt clay beaker, which corresponds to about  $\frac{1}{25}$  of the lime contained in Paris spring water. The growth took place partly in water or in a calcic solution, partly in sand soaked in water or solution. The temperature was maintained at about 20° C. and the experiments were made in the dark. They were continued as long

(1) See R. 1917, No. 813 (Ed)



as growth of the young plants in the calcic solution lasted, while the growth of the plants in pure water ceased much earlier.

The favourable action of lime on growth was confirmed for all the seeds, both as regards length and weight. The action was more marked in the roots than in the stalks. At the same time there was a total loss of dry matter, without doubt caused by the fact that respiration had become more active in the calcic solution owing to the larger growth of the young plant and was not compensated by photosynthesis, as growth took place in the dark. Maize alone seemed to be an exception, perhaps on account of the abundance of its reserves. The reserves were used in unequal proportions, both absolutely and in proportion to final weight, which is in agreement with the earlier observations of MAZÉ. In the seeds of cabbage, buckwheat and radish, the reserves diminished to a slightly less degree than in the control; consequently the writer suspects some errors in the experiments. In the others the diminution was more marked. In any case, lime exerts slight influence on the organisation of the reserves, which proves that it does not act of its own accord on respiration.

L. V.

1038 - **Effect of Röntgen Rayson Cells of *Vicia faba*.** — KOMURO, H (Botanical Institute, College of Agriculture, Imperial University, Tokyo), in *The Botanical Magazine*, Vol. XXXVI, No. 424, pp 41-45 Tokyo, April 1922

Seeds of *Vicia Faba* (var. "Hyôgo") were steeped in water for 77 hours (until they had absorbed 57.87 % moisture), and exposed to rays at various intensities (20 H, 40 H and 50 H). and were then sown in sand. After 8 days, the tips of the radicles were fixed in FLEMING'S fluid together with controls (stained sections etc.). The most noticeable changes were seen with the radicles of specially irradiated seeds: enlargement of the cells of parenchymatous tissue sometimes to an unnatural size and of the nucleus; increase in the number of nucleoli; vacuolisation of nucleolus and cytoplasm, decrease of chromatic substance (karyolytic and occasional pycnotic conditions). Various physiological changes are evident (mitosis, asymmetrical mitosis, multinucleated cells etc.). There is an obvious effect on tissues as a whole. The modifications resulting from intense rays, are considered by the author to be partly due to lessened vitality of the cytoplasm (senescence), that is insufficient for normal division. The author believes the degenerative changes of tumour cells to be of a similar nature.

I.. V.

1039 - **The Effect of Iron and Aluminium Salts upon the Growth of Maize.** — ARNDT, C. H., in *American Journal of Botany*, Vol. 9, No. 2, pp. 47-71, 6 figs, 1 Table, bibliography of 46 works. Brooklyn, N. Y., February 1911.

The investigations of HOFFER and CARR on maize diseases have shown that a brown or brownish-purple discoloration of the lower portion of the nodal tissue is often associated with evidences of malnutrition and root-rot. Chemical analysis revealed the presence of considerable quantities of iron and aluminium in the discoloured areas. The injection of iron salts produced a similar change of colour, increased the ca-

talase and oxidase activities, and reduced the H-ion concentration. Aluminium salts produced no discoloration, but their effect upon the physiological activities were similar to those exerted by iron salts. Stalk and root-rot organisms were usually associated with the accumulation of iron and aluminium in the coloured area.

In 1915 BORDNAR reported a correlation between a high aluminium content of the sugar beet and its infection by bacterial organisms. His analyses showed that an accumulation of aluminium preceded infection, which indicates that it was related in some way to decreased resistance to infection.

The author gives a historical review of the many experiments that have been made on the subject of the toxic action upon plants of an excess of iron and aluminium (which is generally attributed to the increased acidity of the soil), and on the different effects of the various salts.

The object of the author's investigations was to determine the form and conditions of the toxic action of iron and aluminium salts upon maize and he gives a detailed account of the technique employed. Solution cultures were made in the main part of this experimental work, the results being checked with sand cultures. The solution chosen was the one employed satisfactorily by HARTWELL and PEMBER for studying the effect of aluminium sulphate on barley and rye. It contained: acid calcium phosphate, calcium nitrate, ammonium nitrate, potassium chloride, magnesium sulphate with traces of aluminium, manganese and zinc.

The author also tried a quite different and less complicated solution containing acid potassium phosphate, calcium nitrate and magnesium sulphate. This solution was recommended by the Committee on the Salt Requirements of Representative Agricultural Plants.

The iron phosphate behaved very differently in the two solutions.

In the first, the best results were obtained with 7 mg. per litre; with larger or smaller amounts the maize was less vigorous, whereas higher concentrations proved distinctly toxic.

In the second solution the same salt remained inactive, even when used in quantities 5 times as large as in that mentioned above.

The action of the various iron salts was different; thus optimum growth was obtained in the second solution with 0.0005 N. ferrous sulphate, whereas a 0.001 N., or 0.002 N. concentration of ferric nitrate produced a precipitation and the plants became chlorotic. Ferrous sulphate was almost twice as toxic as ferric sulphate, for the latter was more readily precipitated and its depressing effect was closely related to the H-ion concentration produced by its hydrolysis or precipitation.

Sulphuric, nitric and hydrochloric acids were about equally toxic when added to either solution in low concentration. Sulphuric acid is however the best tolerated, especially by the roots. The aluminium and iron salts of these acids behaved in the same manner, their effect depending upon the acid radical.

An initial H-ion concentration less than pH = 3.7 had little effect upon the rate of growth, for in most cases, the plant tended to shift the reac

tion towards neutrality. In this it was not however always successful; thus when ferrous sulphate and certain concentrations of the chlorides were added to the cultures, plant growth increased the initial H-ion concentration of the solution. The reaction was most readily shifted towards neutrality when the acidity was due to sulphuric acid which, as has been seen, had the least depressing action upon growth and therefore the change in the reaction was proportional to the size and activity of the plant.

In the first solution, the aluminium salts remained in solution and were directly toxic, in the second, they were readily precipitated and hence exerted an indirect toxic action due to the H-ion concentration produced. The nitrate seemed to be somewhat more toxic than the other aluminium salts and showed a greater tendency to produce chlorosis.

Both iron and aluminium salts collected in the lower portion of the nodal region, but only the first produced discoloration.

In sand, the toxicity of the acid and salts was much reduced, higher concentrations being needed to produce the same effects.

L. V.

1040 - **Growth of Plants in Relation to Soil Humidity.** — See No. 1014 of this *Review*.

1041 - **Reaction in Fresh Water caused by Aquatic Plants.** — LAPICQUE, L., and KERGOMARD, Thérèse, in *Comptes rendus de la Société de Biologie*, Vol. LXXXVII, No. 26 pp. 512-515. Paris, July 15, 1922.

The writers have experimented on *Spirogyra* and *Elodea canadensis*; they could not make use of *Potamogeton* and Algae (*Mongeotia*?) taken from the Seine because these plants were too laden with bacteria and animalculae which exerted a disturbing action.

They arranged the plants in open vessels containing Seine water or spring water. These two waters had a concentration of hydrogen ions (pH) respectively equal to 7.3 and 7.6: leaving the former standing in the open air its alkalinity slowly increased until it reached pH = 7.8, evidently due to the escape of carbonic acid gas, produced by microorganisms in the pipes. Under the action of aquatic plants in the proportion of 1 gm. of green matter to 50-100 cubic cm. of water, the alkalinity decreased in the dark until a slight acidity was attained, that is to say that it was less than pH = 7, whereas in the light the alkalinity increased and in the sun could, in a few hours, exceed pH = 9 and even reach pH = 10. This action decreased when the sky was overcast.

It is evident that two opposite actions came into play, namely expiration of carbonic acid, which caused the acidity to increase, and chlorophyll assimilation, which caused it to decrease, a fact previously demonstrated by LOEB, by OSTERHOUT, who made use of it as a method for measuring chlorophyll activity and by WURMSER who made much use of that method. The experiments of these writers, made on marine algae had shown only relatively slight variations, not exceeding a logarithmic unit, while in the course of the above-mentioned experiments the variation reached three units.

L. V.

[1922-1941]

1042 - **Effect of Transpiration on Absorption of Salts by the Plant.** — MUENCHER, W. C., in *American Journal of Botany*, Vol 9, No. 6, pp. 311-329, bibliography of 22 works. Brooklyn, N. Y., June 1922.

Several contradictory reports have been issued in connection with this subject. Some men of science state that transpiration, and absorption of soil moisture regulate the absorption of mineral substances, whereas others do not admit this explanation.

In order to clear up these differences of opinion, the author carried out a series of methodical experiments. One of these tests was made with a pure line barley grown for 5 weeks in KNOP's solution, in both summer and winter. Transpiration was accelerated or retarded in three ways.

1) Variation in atmospheric moisture, by limiting air space and introducing moisture by means of atmometers (LIVINGSTON) and running water, or by absorption with calcium chloride.

2) Variation in light intensity, which accelerates or hinders physiological functions and also affects transpiration. The author exposed some plants to direct sunlight and others were grown in the shade.

3) Modification in concentration of the moisture necessary for plant nutrition in such a way as to assist or hinder the osmotic changes in the roots. With this end in view, the KNOP solution was diluted to half strength in some cases and in others the concentration was doubled.

In decreasing transpiration by means of the first method, viz. increasing atmospheric moisture when the concentration on the nutrient solution remains constant, no appreciable variation was noticeable in the amount of ash. If on the contrary, the shading method is employed, that is to say reducing the photosynthetic activity to almost half its usual strength, the quantity of ash is similarly decreased. Reduction of transpiration by means of increased concentration of nutrient solution causes decrease in ash.

As regards dry weight, the amount of ash varies very little even if transpiration is accelerated or hindered.

The results indicate that transpiration has no influence whatever on absorption of mineral salts. On the contrary, it is the quantity of organic matter produced by the plant which regulates absorption. As this increases considerably under the influence of sunlight, the quantity of ash also increases. Darkness has the opposite effect. To a limited extent, but always in an indirect manner the concentration of the nutrient solution surrounding the roots and atmospheric moisture surrounding the leaves behaves in a similar way. In every case the relation between the total weight and the quantity of ash remains constant.

The author has made several investigations in order to study the effect of different conditions on the root and shoot. The most important conclusion to be drawn from the results obtained was that, compared with the stem, the root develops more vigorously in the shade than in the sunlight, (determinations with dry matter). This deduction is not applicable in connection with the effect of light or darkness on transpiration. There is no appreciable difference in this respect, between plants grown under moist conditions and those grown under dry conditions. L. V.

1043 - **Process of Assimilation of Phosphoric Acid in Plants.** — See No. 1027 of this Review.

1044 - **On the Catalysis of Seeds.** — DE VILMORIN I., and CAZAUBON, in *Comptes rendus de l'Académie des Sciences*, Vol. 175, No. 1, pp 50-51. Paris, July 3, 1922.

SEEDS

A. NÉMEC and F. DUCHON had shown that the germinative faculty of seeds decreased parallel with the force of catalysis. The writers confirmed that result for some varieties of peas, and showed the relationship very clearly.

In this work they have taken up the enquiry for very slowly germinating seeds of trees, with the object of replacing, if possible, the determination of catalysis by germination tests. They experimented with varieties of pines and larches, but the relationship failed, probably because these seeds have an impermeable envelope.

There have also been cases in which the seeds, though obviously dead, still reacted strongly on oxygenated water producing a considerable liberation of oxygen. After heating for half an hour at 100° C the amount of gas liberated became insignificant.

L. V.

1045 - **Weight and Size of Seeds as Factors influencing Yield.** — See No. 1011 of this Review.

1046 - **Hard Moroccan Wheats.** — MIÈGE, E., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol VIII, No 17, pp. 522-527, May 10, 1922 and No 20, pp. 584-588, May 31, 1922. Paris.

CEREALS  
AND  
PULSE CROPS

Wheat cultivation covers an area of about 800 000 ha. in Morocco. The varieties grown are all of more or less impure. The different forms can however be isolated and may be grouped in classes corresponding to four essential types Zréa, Trikkia, Asker and Maizza. The Zréa group has generally straight elongated, pyramidal fairly compact ears tapering at the top, with long white or slightly pigmented awns and with solid or semi-solid straw. The grain is large, decidedly hard, non-symmetrical with concave base. In this class, the white Zréas and the red Zréas wheats are well known and much valued.

The Trikkia group is also very common ; it is characterised by a short, highly compact, oblong or triangular ear sometimes club shaped and curved, very broad in section ; the grain is non-symmetrical, with the base usually flat or even slightly convex and with the apex often crooked. The straw is solid or semi-solid and shorter than that of the Zréas. The wheats are divided into white and red varieties.

The Asker group is especially common in northern Morocco ; under this designation are classed the smooth eared varieties, yellow or white, with white awns and solid straw, hard grain, shorter and thicker than the preceding, more rounded and always of a dark colour. The ears are fairly long, semi-open, generally cylindrical and much narrower than the Trikkias and Zréas. This class is grown on poor soils.

The Maizza group includes all the blackeared wheats ; it is divided into smooth Maizza and hairy Maizza. It is a complex group directly

allied to the two principal classes of white wheats, the Zréas and the Trikkias.

A comparative study of these wheats has been made for a year. They were sown on the December 1, 1920 in a poor sandy soil, in lines 20 cm. apart, at a depth of 7 cm. and each grain was 5 cm. from the next. The rainfall for the year was rather above the average. The hard Moroccan wheats have shown themselves to be rather late, somewhat subject to rust but possess good agricultural qualities. The Zréas have given the best results, especially the white smooth kinds. The average weight of the ears exceeds 5 grammes. The Trikkias are placed second with an average weight of ears 4.37 gm.

The Maizzas, inferior to the former, are however better than the Askers.

Chemical analysis indicates a high percentage of nitrogenous matter sometimes exceeding 15 % and very little moisture.

In short, according to this preliminary test, the hard Moroccan wheats are wheats of excellent quality and value. P. C

1047 - **Is the Transplantation of Maize advantageous?** — MORETTINI, A. (R. Istituto Superiore Agrario Sperimentale, Perugia), in *L'Italia agricola*, Year 50, No. 8, pp. 259-263. Piacenza, Aug. 1922.

SCHREBER in France and ULPANI in Italy have suggested the transplanting of maize so that it may serve as a second crop after wheat. This method is not however employed in any of the countries where maize is cultivated. As no experimental data were available, the writer has tried this method several times at San Donà di Piave and on the estate of Casalina, attached to the Institute of Agricultural Experiments at Perugia and has made the following report:—

1) The growth of maize by transplanting is technically possible, as the plants take root again fairly easily and slight watering at the time of transplanting suffices to ensure that more than 90 % take root again in normal conditions.

2) As compared with plants from direct sowing, those which have been transplanted have greater root development owing to the greater number of internodes covered by the soil, and not less development of the part above ground; they ripen 10 to 15 days earlier and certainly give a higher yield. On the other hand there is the increased cost of labour, which, in ordinary circumstances makes the transplantation of maize generally undesirable, except in special conditions as for example to replace crops that have failed or blanks caused by insects or other agents in ordinary crops, or else as a second crop after wheat. F. D.

1048 - **Competition in Rice Transplanting in the Province of Novara (Italy) in 1921** (1). — NOVELLI, N., TOGNATO, L., and ROFFIA, A., in *L'Agricoltura pratica*, year XXVI, No. 2, pp. 24-31. Novara, 1922.

With the object of encouraging rice growers to adopt on a large scale the practice of transplanting, the "Comitato provinciale di Propaganda

(1) See R. Nov. 1921, No. 1113. (Ed.)

per le colture alimentari della provincia di Novara" in collaboration with the "R. Stazione Sperimentale di Riscoltura" of Vercelli and with the "Cattedra ambulante di Agricoltura" of the Province, held a prize competition for the agricultural year 1921. The prizes amounted to 22 000 lire and the total area of the competing rice fields measured 163.20 ha. The variety grown was in all cases but one (Onsen), the original Chinese rice. The present article was the Report of the examining Committee for the competition. Out of 27 transplanting experiments, 9 were made on a new ricefield, — 13 after rape for seed — 1 after colza for seed — 1 after rye for seed — 2 on fallow land — 1 on a 10 year old rice field. The production of rape and colza was 7.50 qx. to 13 qx. of seed per hectare, and that of the first crop of hay from 22 to 42 and up to 70 qx per ha.

Transplanting was limited to small portions of the rice field ; it was easy to make comparisons at any point between the transplanted rice and that grown in the ordinary way ; they showed that transplanting itself allowed very high average productions of 60 to 65 and up to 78 qx of paddy per hectare to be obtained.

In all these tests and to a more marked degree than in those of former years, thanks to the increasing improvement in method especially as regards the date of transplanting, the number of plants in each small bunch, the distance between the bunches, etc., the various and important advantages which are the result of the adoption of transplanting have been observed. They may be summed up as follows :—

- 1) a surplus production of from 8 to 10 qx of paddy per ha. ;
- 2) a secondary crop of rape, colza, forage, or in any case of good green manure ;
- 3) less impoverishment of the soil consequent on shorter submersion ;
- 4) better grown stalks, and consequently greater resistance to lodging ;
- 5) increased development of the panicles and the grain and greater purity of the seed.
- 6) better distribution and increased employment of manual labour.

1049 — **The Encouragement of the Growth of Lupins in Germany.** — SIMON, Prof. (Dresden), in *Deutsche Landwirtschaftliche Presse*, Year 49, No. 46, pp. 316-317, 2 figs. Berlin, June 10, 1922.

The growth of lupins is being developed in Germany and should be encouraged, as the seeds, when deprived of their bitterness by improved methods give an excellent food, rich in protein. The writer remarks that the plant grows not only on light soils, as is generally believed but also on sandy-loam and close granitic soils ; it is only necessary that the soil should not contain too much lime (1). Thanks to its vigorous and well developed root system, the lupin is able to find its food even in poor soils ; this observation is specially applicable to phosphorus. Further, like all the Leguminosæ, this plant enriches the soil with nitrogen, and is therefore an

(1) See R. May-June 1922, No. 551. (Ed.)

advantageous crop. In order to secure nitrogen fixation it is necessary to have recourse to inoculation. Although some species of lupins, including the yellow, have been grown in Germany for a long time, its general diffusion is still limited. For this reason the root-inhabiting bacteria of the lupin are either not common in soils in Germany or entirely absent. It is true that, in many places, similar plants are found such as the little *Ornithopus perpusillus* of sandy uncultivated soils, and certain perennial species of lupins native of North America, grown for ornamental purposes or found in woods; but the bacterial species which are special to them, when inoculated on lupins, only produce a feeble growth of nodules.

The Saxon Experimental Station of Vegetable Physiology at Dresden has made various experiments of inoculation of lupins with root-inhabiting bacteria of various other Leguminous plants. For the yellow lupin (*Lupinus luteus*) only the bacteria of serradella (*Ornithopus sativus*) hasten the growth of the plant in similar degrees to those of the bacteria of the yellow lupin itself; the bacteria of other Leguminous plants, such as beans, vetches, red clover, etc. are inert, and the growth of the plant takes place with difficulty, as with the uninoculated control. It is therefore desirable to make use of bacterial colonies taken from the lupins themselves. The inoculation of the soil with another soil is difficult, costly and uncertain and the inoculation of seeds with pure bacterial cultures is preferable. When the crop is already advanced, it may still be worth while to make a late inoculation.

Inoculation is indispensable in soils on which lupins are grown for the first time, but naturally this does not suffice in itself and for example the plants must have a certain amount of potash and phosphorus at their disposal.

For twenty years the bacterial cultures "Azotogen", supplied by the Dresden Experiment Station, have given excellent results. The growth of lupins has succeeded very well even in very poor, granitic soils cultivated for the first time: the inoculated lupins have made a vigorous growth, while those not inoculated have grown poorly.

Inoculation will prove very important for making large areas cultivable. In this connection the writer states that in Germany there are still 2 million hectares of non-marshy land uncultivated and a still greater area of marshy land.

L. V.

1050 - **Action of various Manures on Beans.** — VAN HAUTEN, A. (Landw. Versuchsfelde der Universität Göttingen), in *Journal für Landwirtschaft*, Vol. 70, No. 1, pp. 1-7. Berlin, July 1922.

Autumn sowings were made in 8 plots, which had already been manured in previous years and in which the last crop had been barley; they contained average amounts of phosphates and lime. Spring manuring was given with 50 % potassic salt, sulphate of ammonia and basic slag variously compounded.

During growth the lack of potash was already revealed in the plots to which no potassic fertiliser had been applied: the plants did not flourish



and the leaves turned yellow, these differences becoming more marked after flowering. In the plots which were defective in potash, maturation was earlier, but the yield lower; on the other hand manuring with potash caused the yield to show a constant increase though to a less degree when manuring with potash was accompanied by manuring with phosphates. Nitrogenous fertilisers did not have any beneficial effect, which is to be explained by the fact that the beans are able to supply themselves with nitrogen. Phosphatic fertilisers were clearly injurious, evidently because the soil was already over supplied. The yield, in quintals per ha., was as follows: control 12.20 — with potassic fertiliser 16 — with phosphatic 11.40 — with nitrogenous 10 — with potassic and nitrogenous 16 — with potassic and phosphatic 13 — with phosphatic and nitrogenous 8 — with the three fertilisers combined 15.60.

At the same station, FEST had obtained, in 1908, a similar result with the same fertilisers. In estimating the yield in dry matter, the general results are not modified appreciably. The average size of the seeds was very nearly the same, their weights varied from 36.23 to 41.01 gm. per 100 seeds.

The percentage of crude protein was less in the seeds of the potash plots, because, in the latter stages of maturation, the non nitrogenous extracts are preferentially deposited in the seeds. In the potash plots, the maturation of the seeds and consequently the deposit of the non-nitrogenous substances, could be completely effected. Absolutely however, the amount of protein was greater in the potash plots.

Contrary results were given for starch and fats. On the other hand, the percentage of ash was greater in the potash plots, and potash in large quantities was found in the ash.

L. V.

1951 — **Brazilian Forage Plants** (1). — DE SOUZA BRITO, E. C. (Escola Superior de Agricultura e Medicina Veterinária), Apontamentos sobre as nossas principais forragens nativas e cultivadas, *Ministerio da Agricultura, Industria e Commercio, Serviço de Informaões*, Rio de Janeiro, 1918. — A. LAVOURA, *Boletim da Sociedade Nacional de Agricultura*, Year XXIV, Nos. 9 and 10, pp. 380-385; Nos. 11 and 12, pp. 425-432. Rio de Janeiro, Sept.-Dec. 1921.

**FORAGE CROPS,  
MEADOWS  
AND PASTURES**

Dr. DE SOUZA first considers the importance of the forage question for Brazil. He then quotes all that the Argentine has done to improve its pastures by replacing the hard native grasses by more tender grasses and especially by acclimatising leguminous plants from Europe. He then studies, from a practical standpoint, the principal Brazilian forage plants, indigenous and cultivated, at least such of them as have been determined botanically, analysed and tested in the "postos zootechnicos".

INDIGENOUS FORAGE GRASSES OR THOSE WHICH HAVE BECOME WILD.

— 1) "Capim gordura" or "Catingueiro" (*Melinis minutiflora*) (2). — This is one of the commonest forage plants in almost all the States of

(1) See R. 1915, No. 472; R. 1917, No. 1020; R. 1921, Nos. 386, 1116 and 117.

(2) Syn. *Panicum minutiflorum*. See R. 1915, No. 201; 1917, No. 18; 1921, No. 816. (Ed.)

Brazil. Under a temperate climate, it forms permanent pastures, sometimes very extensive, as in the numerous "fazendas" in the States of Rio de Janeiro, São Paulo, Goyaz, etc. It grows well with the Leguminosæ. According to the analyses which have been made at the "Posto Zootecnico Federal", it contains, before flowering, 12.8 % of digestible nutritive substances, with a nutritive ratio of 1 : 20, and after flowering, 21.9 % of digestible matter with a nutritive ratio of 1 : 11.4. The hay contains 49 % of digestible substances. This plant is chiefly suitable for milch cows. There are 3 varieties:— "gordura branco" (white var.) — "gordura roxo de hastes finas y longas" (red var. with long thin stalks) — "gordura roxo de hastes curtas" or "cabello de negro" (red var. with short stalks). The first does best on strong deep soils; the red "capim" prefers stiff soils. This grass is resistant to drought; but not to excessive moisture.

2) "Graminha" or "Capim de burro" (*Cynodon Dactylon*). — Couch-grass is common all over Brazil. The "carrapicho beijo de boi" (*Desmodium ascendens*) is one of the very few leguminous plants that can be associated with it. It resists drought and trampling very well. Before, during and after flowering it contains respectively 21.8 — 26.7 — 31.8 % of digestible nutritive matter, with the nutritive ratios 1 : 10 — 1 : 10.7 — 1 : 13.

3) *Chloris orthonoton*. — Perennial forage plant in high and low meadowland. It is one of the most hardy grasses; it is very tender and delicate and is easily propagated by seed and resists cold and drought. These qualities make it useful, although it has no great nutritive value. Dr. DE ANDRADE found in it 6.8 of nitrogenous matter per 100 of dry matter.

4) "Capim mimoso". — This name is given to several species of grasses, some of which are not yet classified and which grow on natural pastures in areas having a temperate climate. The "capim mimoso" of Matto Grosso and of Goyaz is *Eragrostis pelosa*, very rich in nitrogen (12.66 % of the dry matter) and, consequently, very much recommended for fattening cattle. The same species is called "panasco" in Ceará.

At Parana, this name is given to both *Andropogon tener* var. *Neesii* and *Paspalum marginatum*. The latter does not grow large, but it is well liked by cattle; it stands cold and drought and burning does not destroy it. The grass is common both in the State of Minas Geraes and on the ridges of the Lapa and Urubú.

*Andropogon tener* var. *Neesii* is one of the good forage plants of Parana; it is tender and stands cold, drought and trampling. It also grows in the States of Minas Geraes and São Paulo. On the fertile and cool soils of the States of São Paulo and Parana grow two other species which bear the name "capim mimoso": — *Panicum capillare* and *P. nitidum*. Their nutritive ratios are respectively 1 : 4.1 and 1 : 6.2

Another "Capim mimoso", *Eragrostis lugens* var. *glabrata*, grows on the most fertile soils of Minas and Goyaz up to Montevideo; it is much liked by animals.

5) "Graminha de Campinas" (*Chloris radiata*). — This has neither great growth nor is it hardy, but the grass might be used for making winter pasture. It contains, in the dry matter, 5.4 of nitrogenous matter, and has a nutritive ratio of 1 : 8. Like all species of *Chloris*, it flowers all the year round and produces much seed. Its propagation is easy and as a good forage plant it is worth growing. It is very common in the little frequented pastures of the States of São Paulo, Matto Grosso and Goyaz.

6) "Capim flor" "flecha" or "lanceta" (*Panicum echinolaena*). — Several species of the genera *Letochlopa* and *Tristachya* bear the same common names. *Panicum echinolaena* grows on the upland of Uberaba up to Goyaz, Minas, etc., where breeders think highly of it. Before flowering it is tender and then becomes slightly tough. According to an analysis made at the "Instituto Agronomico" of Campinas (*Boletim de Agricultura de São Paulo*, March 1914), the nutritive ratio is 1 : 6.5 ; its composition is therefore good. The grass has a creeping habit and prefers cool soils ; it withstands fires and forms a good constituent of winter pastures.

7) "Capim branco" (*Paspalum brasiliense*). — Very common in Uberaba, Parana, Goyaz, etc. It is slightly hairy, but tender and well liked by cattle.

8) "Capim do campo" (*Panicum cayennense*). — In Para it bears the name of "pennacho". It grows in the States of Parana, São Paulo, Minas, Goyaz, Pernambuco, etc. Cattle only eat the plant if better forage is lacking, because the blades are hairy and prickly. It stands drought and cold well.

9) "Grama commun" (*Paspalum notatum*). — It forms extensive pastures of good forages which grows all the year round. It contains 6.11 % of nitrogenous matter and has a nutritive ratio of 1 : 5.7.

10) "Grama das raças" or "grama comprida" (*Paspalum dilatatum*). — Indigenous and very common in southern Brazil ; cattle like it well ; of high nutritive value and contains 7.94 % of nitrogenous matter, and has a nutritive ratio of 1 : 4.5.

11) "Capim guiné legitimo" (*Panicum maximum*). — Although probably of African origin, is native on dry soils throughout Brazil. It is perennial, of fairly high food value, easily grown, stands drought and is well liked by cattle ; makes good hay and gives several crops a year. Eight varieties are known, all of good quality. The analysis of plants before flowering, made at the "Instituto agronomico" of Campinas, gave as composition of the dry matter :— Nitrogenous substances 9.25 % — fats 1.96 — organic matter 65.67 — non nitrogenous matter 32.26 — cellulose 22.2 — Nutritive ratio 1 : 3.8. It is the forage grass which is preferred in the Antilles, as it will support a large head of cattle. It is specially suited to rather sandy and humiferous soils.

12) "Capim Jaraguá" or "capim provisorio" (*Andropogon rufus*) (1). — In Matto Grosso the plant is termed "Sapé gigante" and "Capim vermelho" in Goyaz. It is native in the State of Goyaz, Matto Grosso and

(1) See R. 1917, No. 1154. (Ed.)

Planhy ; perennial ; tillers strongly and grows to a large size. Cattle are partial to it. Thrives on cool clay soils and makes good hay provided that it is cut before flowering. It requires annual burning (which can be replaced by heating) and, on fertile soils, a large head of cattle, which slows its growth and delays its hardening.

According to Dr. ATHANASSOF'S analyses, at the " Instituto Agronomico " of Campinas, its digestible nutritive constituents and nutritive ratio have respectively the following values :—*for green forage* :— before flowering :— 15.6 % ; 1 : 6.8 — during flowering period :— 18.9 % ; 1 : 20.2 — after flowering 20.33 % 1 : 25 — *for hay* :— made from grass before the flowering stage — 47.8 % ; 1 : 10.4 — made from grass after flowering 55.03 % ; 1 : 15.3. It forms excellent pastures by growing together with " capim gordura " and leguminous plants.

13) " Capim colônião " or " milhã roxo " (*Paspalum virgatum* var. *conspersum*). — It grows in low cool soils ; is easily propagated ; gives good hay, provided it is cut before flowering — Percentage composition (dry matter) :— Nitrogenous matter 6.07 — Fats 1.45 — Non-nitrogenous extracts 35.14 — Cellulose 5.14 — Organic matter 68.07 — Nutritive ratio 1 : 6.4. The name " milhã " is also given to the following allied species which have the same habitat and which, like the preceding grass, do not stand frost :— *P. griseum* (" milhã branco ") of Parana and São Paulo — *P. intermedium* (" milhã ") of São Paulo — *P. malacophyllum* (" milhã roxo ") — *P. aureum* (" milhã doirado ") of São Paulo Minas, etc. — *P. densum* (" milhã branco " or " milhã da Colonia ") — *P. conspersum* (" milhã do brejo ") — *P. altissimum* (" milhã colônião ") — *P. Cruz-Ardeae* (" milhã de campo ") — *P. laeve* " milhã do campo cultivado ").

14) " Pasto imperial " (*Paspalum scoparium*). — Indigenous from the Amazon up to Montevideo. There are 4 varieties :— 1) smooth ; 2) hairy ; 3) with small flowers ; 4) with narrow blades. The height exceeds 1 m. ; it is propagated by rhizomes and by seed ; is resistant to heat. Plants analysed after flowering contained in the dry matter :— 6.64 % nitrogenous matter ; 2.10 fat ; 37.33 nitrogen free extract ; 21.82 cellulose ; 67.89 organic matter ; nutritive ratio 1 : 6.4.

15) " Capim fino de folhas longas " (*Panicum oppresum*). — In Para the plant called " cannarana fina ". It grows on the low lands of the State of Rio de Janeiro and of northern Brazil and prefers clay soils and provides a good forage.

16) " Capim de planta " (*P. numidianum*). — Has little nutritive value, but on cool soils gives every year several heavy crops. Nutritive ratio from 1 : 10 to 1 : 13.2.

17) " Capim de Angola " (*Panicum spectabile*). — Introduced from Africa when colonisation commenced, it is grown in the low lands and is found wild on the banks of the Amazon and Guaporé rivers in the States of Pernambuco, Bahia, Ceará, as well as in the Guianas and the Lesser Antilles. Nutritive ratio 1 : 3.2.

18) " Barba de bode " (*Aristida pallens*). — Grows in São Paulo,

Rio Grande, etc. Cattle eat it so long as it is young and tender. Before flowering, its nutritive ratio is 1 : 4.2 ; after flowering 1 : 10.

Several other species, all of small nutritive value bear the same common name :— *Sporobolus argutus*, nutritive ratio 1 : 10.2 — *Andropogon condensatus*, nutritive ratio 1 : 9.36, of Rio Grande and Minas Geraes — *A. paniculatus*, *Ctenium cirrhosum*, of sterile lands of Minas Geraes and other States — *Eragrostis reptans* of the island of Marajó, characteristic of low clay soils, stands drought, and is useful for horses. There are still other forage plants of the same class :— “Capim limxo” (*Elionurus candidus*) of Rio Grande do Sul, frequent on the sand hills, bitter and, consequently, little liked by cattle — “Capim membeca” (*Andropogon virginicus*), which grows in several States — “Capim branco” or “pasto branco” or “Moroto” (*A. glaucescens*), very common in Minas, Goyaz and São Paulo — “Capim amargoso” (*Elionurus latiflorus*) gives good hay and animals only eat it dry ; it can therefore form reserve pastures for the summer (dry plants) or for winter (frozen plants).

19) “Capim bobo” (*Andropogon saccharoides*). — Abundant in Matto Grosso and in the State of São Paulo, on the edges of woods. It does not stand drought, has need of shade and is very nourishing. Nutritive ratio 1 : 4.1.

20) “Capim gigante” (*Tripsacum dactyloides*). — Is considered a good forage in the high lands of Marajó and Pará, but is much more common in Goyaz. The plants in flower reach a height of 3 metres.

21) “Capim burrão”, “grama de Jacobina” (*Chloris bahiensis*). — Excellent forage plant of the interior part of the State of Bahia, and also that of Pernambuco, Pará and some of the Southern States up to Montevideo. It contains in its dry matter :— Nitrogenous matter 10.32 % — Fats 1.18 — nitrogen-free extract 30.27 — Cellulose 19.43 — Organic matter 61.20 — Nutritive ratio 1 : 3.2. Requires cool fertile soils and is worth growing on a large scale on account of its high food value and its facility of adaptation to various zones of the country.

22) “Capim doido”, “capim comprido” (*Andropogon Minarum* Kunth. = *Sorghum Minarum* Hack). — Native and common in several zones of the States of Minas, Espírito Santo and São Paulo. It seems to prefer heavy soils. Perennial ; height about 1 metre ; has never, so far as is known, caused poisoning.

Another sorghum, *Sorghum halepense*, is grown in the State of São Paulo, which has shown itself very nourishing and stands trampling.

23) *Panicum cordatum*. — Grows only in the low lands of the State of Rio de Janeiro, where it is common on the banks of ditches. It is an excellent forage plant cut for use green and will probably make good hay..

24) “Pampuan” or “papuan” (*Ichnanthus caudicans*). — Breeders give this name to several forage plants much esteemed in the interior of Goyaz and of some other States, and which are well suited for fattening cattle. Six varieties of this species have been identified. In the States of Minas, Goyaz São, Paulo and Matto Grosso, the same common name is gi-

ven to a species of *Panicum*; in Pará and Rio Grande do Sul, *Paspalum jurcatum* is called "pancuan".

25) "Capim assú" (*Panicum megiston*). — Good forage plant of the island of Marajó; grows on sandy-argillaceous soils, is hardy and reaches a height of 10 metres. It can be mown.

In the interior of Minas, of São Paulo and on the low lands of Parana, the same common name is given to *Erianthus Trinii*, a good forage plant resistant to cold and drought. In the interior of the State of Bahia, this name is given to *Eragrostis brasiliensis* Nees = *E. bahiensis* Schultes, a perennial plant of about 1 metre in height, well liked by cattle. *Hemiarthria fasciculata*, a fairly good forage plant also bears the same name.

26) "Pé de gallinha". — Several forage grasses some of which have little nutritive value, bear this name:— *Eleusine indica*, common on the heavy soils throughout Brazil (it is called "capim de burro" in the north); it is tender and, under cultivation, gives an abundant production; nutritive ratio 1 : 3.3 — *Cynodon Dactylon*, more often called "graminha" — *Panicum sanguinale*, very common especially in Matto Grosso, São Paulo and Rio Grande do Sul; gives good hay if it is mown before flowering. — *P. Crus-Galli* — *Poa annua*, common in Rio Grande do Sul and São Paulo.

27) "Capim manexim" or "pé de papagaio" (*Eleusine coracana*). — Before flowering, this plant is very tender; the nutritive ratio is 1 : 3 and it makes good hay.

28) "Grama de Pernambuco" or "capim de Macahé" (*Paspalum mandiacanum*). — This plant grows abundantly on fertile soils. Before and after flowering the nutritive ratio is respectively, 1 : 5.6 and 1 : 3.9. When tender, cattle eat it, but only in the absence of other forage. It is indigenous in the Northern States. Owing to cultivation in the State of São Paulo the composition has been much improved; it contains 8.75 % of nitrogenous matter, with a nutritive ratio of 1 : 4.5. It gives from 4 to 7 abundant crops per year.

29) "Capim gordo" (*Paspalum conjugatum*). — In Pará it is called "capim de marreca". It is native on cool soils of Rio Grande, Parana, the island of Marajó and the South of Matto Grosso. Nutritive ratio 1 : 3.3 before flowering; 1 : 4.9 after flowering. The grass is non resistant to drought.

30) "Capim cocorobó", "capim batatal", "capim cebola", "graminha de Araraquara" (*Chloris distichophylla*). — Grows on sandy shaded soils in several parts of Brazil and Uruguay. Does not stand drought but its composition makes it one of the best forage grasses of Brazil; before flowering the nutritive ratio is 1 : 5.8; during the flowering period 1 : 4.5; the hay contains 7.09 % of protein.

31) "Grama mineira" (*Stenotaphrum glabrum*). — Grows on dry soils; stands drought, but not trampling; perennial; nutritive ratio 1 : 3.2; said to be of English origin, native in Matto Grosso, Minas, etc.

32) "Grama major Ignacio", "grama de S. Carlos" (*Paspalum laxum* Lam. = *Paspalum plantagineum* N. b. E.). — Very common species at S. Carlos do Pinhal (São Paulo), in Minas, Bahia, Rio de Janeiro.

When cultivated, it gives 6 to 7 crops a year, with a total yield of about 50 tons per ha. The nutritive ratio is narrow, namely 1 : 3.7 before flowering and 1 : 4.3 after.

33) "Capim Araguaya". — This is a still undetermined species of *Paspalum*, very common in the States of Goyaz and Matto Grosso, very much valued as a forage plant. Grows on damp soils and makes good hay.

34) "Cevadilha" (*Bromus unioloides*). — Indigenous in Parana; it is the "resene grass" of North America and the commonest forage plant of the Province of Buenos Aires. It is suitable for cultivation; when trampled by animals it becomes perennial. Nutritive ratio before flowering 1 : 3.6.

35) "Capim palmeira", "capim legue" (*Panicum sulcatum*). — Remarkable for its abundant production and its exceptional richness in nitrogenous matter; nutritive ratio 1 : 2.6 before flowering and 1 : 2.7 after.

The following species, for which the States where they are commonest are indicated, are considered good forage plants:—

36) "Capim setaria" (*Setaria brachiata*): — Ceará.

37) "Capim andrekiçé" (*Leersia Lexandra*): — Pará, Goyaz.

38) "Peua" (*Andropogon brevifolius*): — Pará, Goyaz, Amazonia.

39) "Capim zabo de rato" (*Panicum villoides*):— Pará and other States.

40) "Sentinella" (*Paspalum parviflorum*): — Pará, Goyaz, Espirito Santo.

41) "Grama do cerrado" (*P. obtusifolium*): — Paraná.

42) "Cannarana rasteira" (*P. repens*): — Pará, Matto Grosso.

43) "Cannarana de folha minda" (*Panicum amplexicaule*): — Pará etc.

44) "Cannarana roxa" (*P. zizanoides*):— Pará Matto Grosso, Bahia, Minas, Rio Grande.

45) "Capim mimoso do Piahy" (*Dactyloctenium aegyptiacum*):— Pará, Ceará, etc

46) "Forquilla" (*Paspalum papillosum*):— Pará, etc.

47) "Murukiá" (*Eragrostis VahlII*): — from Pará to Southern Brazil.

48) *Paspalum platycaulon*:— Rio Grande do Sul.

49) "Grama de ponta" (*Triticum repens*): — Rio Grande do Sul.

50) "Coqueirinho" (*Paspalum plicatum*):— Rio Grande do Sul.

51) "Capim arroz" (*Panicum oryzoides*):— Sao Paulo and other States.

52) "Capim gengibre" (*Paspalum falcatum*):— São Paulo, etc.

53) "Capim felpudo" (*Panicum* sp.).

54) "Capim de cheiro" (*Kyllingia odorata*):— Rio Grande do Sul and States in the north.

55) "Capim cevadinha" (*Bromus inermis*):— Considered to be an exotic; it is native in the State of São Paulo.

56) "Capim jaguaré" (*Panicum* sp.):— Rio Grande do Sul.

- 57) "*Grama lanceta*" (*Chloris* sp.): — Campos-Rio.  
 58) "*Capim marambaia*" (*Chloris* sp.): — littoral.  
 59) "*Capim camalote*" (*Rottboellia compressa* var. *fasciculata*): — on high dry lands of Matto Grosso; excellent forage; durable.

EXOTIC FORAGE GRASSES. — "*Capim de Rhodes*" (*Chloris Gayana*) and "*capim favorito*" or "*capim de Teneriffe*" (*Tricholaena rosea*) have been introduced into Brazil and grown with success.

INDIGENOUS OR ACCLIMATISED LEGUMINOUS FORAGE PLANTS: —

60) *Zornia diphylla*. — Common throughout Brazil; gives a good hay with 9 % of digestible protein and is well liked by cattle. Thirteen varieties have been identified.

61) *Galactea tenuiflora* var. *villosa*. — Common in Rio Grande do Sul. Perennial. The dry matter contains 19 % of nitrogenous matter.

62) "*Carrapicho beço de boi*" or "*amor de campo*" (*Desmodium ascendens*). — Grows all over South America and in the Lesser Antilles. Associates well with grasses, stands cold and drought and does well on all soils, but best on heavy soils; is easily propagated and is suitable for all kinds of domestic animals. Nutritive ratio 1:5.5.

63) "*Barbadinho*" or "*Carrapicinho*" (*Desmodium barbatum*). — Grows throughout South America; eaten by all domestic animals. Nutritive ratio before flowering 1:3.2. More than fifty species of this genus abound in Brazil; among them: — *D. albiflorum* — *D. asperum* — *D. axillare* — *D. cuneatum* — *D. pachyrhizum* — *D. uncinatum* — *D. incanum* — *D. bracteatum* — *D. molle* — *D. leiocarpum* ("marmellada de cavallo") (1) with a nutritive ratio of 1:2.5 before flowering and 1:2.8 for the hay — *D. cajaniifolium*, nutritive ratio before flowering 1:2.7 — *D. tortuosum* Welb. = *D. spirale* D. C. ("erva di mendigo", "trevo da Florida"); nutritive ratio 1:2.3 before flowering and 1:2.8 for the hay.

64) "*Capim bambú*" (*Cassia Langsdorffii*): — Common throughout southern Brazil.

65) "*Carrapicho*" (*Aeschynomene falcata* var. *pleurijuga*): — in almost the whole of South America, in Brazil, etc.

66) "*Lentilha do campo*" (*A. brasiliiana*): — Pará.

67) "*Sensitiva mansa*" (*A. sensitiva*); nutritive ratio 1:2.8. *A. americana* Liv. (Glazion), *A. tyacursis* n. sp. Tomb. (Glazion), *A. marginata* and *A. hystrix* are also good forage plants.

68) *Cassia rotundifolia*. — Throughout Brazil, Central America, the Lesser Antilles.

69) "*Feijãozinho*" (*Rhynchosia minima*). — In the States of the North and in the districts of the South with a temperate climate. Must not be confounded with "*olho de pomba*" (*R. phaseoloides*), the leaves of which are supposed to contain a poison, whereas the former is quite harmless.

70) *Vigna vexillata*: — Australia, India, Tropical Africa, Central America and part of Brazil. Good forage plant.

(1) See R. 1920, No. 1097. (Ed.)



71) "Feijão de praia" or "batata sana" (*Vigna luteola*): — Pará, Amazonia, São Paulo. Very much liked by horses.

72) "Wassourinha" (*Stylosanthes viscosa*). — Associates with grasses. Requires cool soils. Cattle are very fond of it. There are 10 species of this genus in Brazil.

73) *Clitoria cajanifolia* Benth. = *Lotus fluminensis* Well. — Common throughout Brazil and in Central America. Bears the name "espe-lina falsa". The same common name is also given to *C. guyanensis*, a good forage plant of the interior of Brazil. There are 15 species of this genus in Brazil.

74) "Oro" (*Phaseolus panduratus*). — Excellent forage plant of the Northern States; the hay contains 18.8 % of digestible protein.

This genus contains 28 species in Brazil, all of them excellent forage plants; the principal of them and their habitats are: — *Ph. Martii*, Ceará — *Pl. longipedunculatus*, Ceará, Pará, Piauí, etc. — *Ph. prostratus*, Rio de Janeiro, São Paulo, Rio Grande do Sul, Minas — *Ph. longifolius*, Rio de Janeiro — *Ph. bruxilensis*, idem — *Ph. lasiocarpus* ("panapanátania" in Pará), Amazonia, Rio Grande do Sul, etc.

75) "Postomeira" or "trifolho hirsuto" (*Eriosema crinitum*): Pará, Minas, Goyaz, São Paulo — *E. longifolium*, *E. stipulare*, *E. strictum*: Goyaz — *E. violaceum*: Rio de Janeiro — have not yet been studied.

76) "Trevo" (*Trifolium polymorphum*) and "trevo branco" (*T. repens*) native in pastures of Rio Grande do Sul.

77) "Manduvira grande" (*Crotalaria paulina*) and "Manduvira pequena" (*C. vitellina*) common throughout Brazil, excellent forage plants.

78) "Feijão de boi" (*C. incana*), much esteemed in Ceará; its dry matter contains 19.5 % of nitrogenous matter. *C. stipularia* and *C. vespertillo*, very nourishing forage plants, grow in Minas and Rio de Janeiro.

79) *Cassia calycioides*. — Common in Goyaz, Piauí, Ric, Pará. The plant, which is not tall is liked by cattle.

80) *Certosema virginianum*. — Throughout Brazil. Other Brazilian species: — *C. pasenorum* — *C. brasilianum* — *C. rotundifolium* — *C. arenarium* — *C. grandiflorum*. — *C. rubescens* — *C. hastatum*.

FORAGE PLANTS BELONGING TO OTHER FAMILIES. — Compositae. — "Cravórana" or "cravoda roça" (*Ambrosia polystachya*); nutritive ratio 1:3.4.

Gentianaceae. — "Asperana" (*Menyanthes brasílica*): — Pará, Rio, Goyaz.

Marantaceae. — "Arumarana" (*Thalia geniculata*; *T. pubescens*): — throughout Brazil.

Amarantaceae. — "Ervanço" or "perpetua" (*Telanthera polygonoides*, *T. ramosissima*, *T. brasíliana*): — Ceará, Rio, etc. Nutritive ratio 1:4.

Euphorbiaceae. — "Velame do Campo" (*Croton campestris*) and many species of "mandioca campestre".

Solanaceae. — "Couvetinga" or "Capeira branca" (*Solanum auriculatum*), of great nutritive value; it is used in Minas.

Ulmaceae. — "Crindiuva" (*Sponia micrantha*):— throughout Brazil. Good forage plant for dairy cattle.

POISONOUS OR SUSPECTED LEGUMINOUS PLANTS. — *Ph. semierectus* ("fãijão de rola," feijão de pombinha"), common throughout Brazil and suspected to contain in its leaves a cyanogenetic glucoside; the same is the case with *Teramnus volubilis*, *T. uncinatus*, *Dioclaea latifolia* ("feijão bravo"), etc. On the other hand the following species have harmless leaves and consequently make good forage, but their seeds are known to contain a cyanogenetic glucoside or are suspected of doing so:— *Ph. lunatus* ("fava Belém") — *Ph. amazonicus* — *Ph. caracalla* — *Ph. appendiculatus* — *Ph. obliquifolius* — *Pachyrhizus bulbosus* ("jacatupéô" — *Canavalia gladiata* ("fava de quebranto" or "feijão mandatô") — *C. versicolor* var. *obtusifolia* ("feijão fava brava") — *Dioclaea violacea* ("coróonha"), etc.

POISONOUS PLANTS BELONGING TO OTHER FAMILIES (1). — Known under the general name of "ervas" they are numerous. The writer notes:—

Compositae — "Mio-mio" (*Baccharis coridifolia*) (2), more common in Southern Brazil. — "Carrasco do campo" (*B. tarchonanthisoides*) — *Homatozona artemisiaefolia*.

Apocynaceae — "Rosa dos campos" (*Dipladenia illustris* var. *tomentosa*; *D. i.* var. *spigelaellora*; *D. i.* var. *velutina*; *D. gentianoides* var. *longiloba*):— Minas, São Paulo, Goyaz, etc.

Acanthaceae. — "Herva do gado" (*Chactothylax lythroides* Lindan = *Heinzelia lythroides* Nees) — a few species of *Ruellia*.

Dioscoreaceae. — Different species of *Dioscorea*.

Passifloreaceae. — "Maracujá de raposa" or "maracujá de rato" (*Passiflora toxicaria*), fruit poisonous, and several other species.

Rubiaceae. — "Herva de rato" or "tangeraca" (*Psychotria Marcgravii*) — "douradinha" (*P. xanthophylla*) and a number of others. The genus *Psychotria* alone includes 12 species, almost all poisonous. They are shrubs which grow on the edges of woods in the middle of forage species; sometimes cattle eat them and are poisoned.

Loganiaceae. — "Arapabaea" (*Spigelia anthelmia*); several other species.

Thymelaceae. — "Embira branca" (*Daphnopsis brasiliensis* and *Funijera utilis*).

Umbelliferae. — "Herva capitão" or "acariçoba" (*Hydrocotyle quinqueloba* var. *angulata* and other varieties of the same species — "Cicuta" (*H. leucocephala*).

F. D.

1052 — Varieties of Maize for Silage Purposes. — See No. 1079 of this Review.

(1) See R. 1917, No. 1034: *Rhynchosia phaseoloides* and *R. minima* considered as poisonous for cattle in the State of Rio de Janeiro. (Ed.)

(2) See R. 1910, No. 477. (Ed.)

1053 - Composition of the Forage Plants "Guinea grass" (*Panicum maximum* and *P. jumentorum*) and "malojillo" (*P. barbinode*) grown at Porto-Rico. — DOMÍNGUEZ, P. A. L., in *Gobierno de Puerto Rico, Departamento de Agricultura y Trabajo, Estación Experimental Insular, Rio Pedras, Circular No. 61*, pp. 35, bibliography of 10 publications. San Juan, 1922.

The "hierba del Pará" or "hierba del Paral" or "malojillo" or "malojilla" (*Panicum barbinode* = *P. muticum*) (1) and the "hierba de Guinea" or Guinea grass (*Panicum maximum* and *P. jumentorum*) are acclimatised and widely distributed in Porto-Rico, where they have found very favourable conditions, the former especially on the north coast, where the rainfall is abundant; the latter, more resistant to drought, on the south coast. They are much relished by cattle.

The annexed Table gives the averages of analyses made at the Rio Piedras Agricultural Experimental Station. The writer also gives the analysis of the hays: in the general average there was 8.13 % of moisture in the hay of *Panicum barbinode*, and 7.05 % in the hay of *P. maximum*.

The writer compares these data with those obtained for the same forage plants, when cultivated in other countries; he refers to several experiments made by other writers to determine their nutritive value and gives formulæ of rations with supplements of concentrates.

*Percentage composition and nutritive coefficients  
of Panicum barbinode and P. maximum, grown in Porto-Rico.*

	Moisture	Protein	Fats	Crude cellulose	Carbo- hydrates	Ash	Nutri- tive co- efficient
<i>Panicum barbinode:</i>							
Average of all samples (9) . . .	75.97	2.15	0.63	6.47	9.97	2.10	5.3
Samples grown on clay soils. . .	75.23	2.03	0.58	6.12	8.13	2.49	4.9
Samples grown on sandy soils . .	75.51	2.05	0.60	7.27	11.21	2.14	6.5
Green plants . . . . .	82.02	2.18	0.76	5.13	7.47	1.40	4.2
Ripe plants . . . . .	72.95	2.13	0.56	7.48	11.37	2.43	5.9
<i>Panicum maximum:</i>							
Average of all samples (4) . . .	73.69	1.68	0.578	8.31	10.91	2.53	7.2
Samples grown on clay soils . .	74.17	1.77	0.693	7.96	9.90	2.69	6.4
Samples grown on sandy soils . .	73.21	1.60	0.464	8.65	11.92	2.37	8.2
Green plants . . . . .	77.38	1.81	0.539	6.67	9.61	2.27	5.9
Ripe plants . . . . .	70.00	1.56	0.618	9.94	12.21	2.78	8.7

F. D.

(1) Some writers give this plant the name of *Panicum molle*, but it belongs to another species. (Author's Note)

1054 - Para Grass (*Panicum barbinode*) and Paspalum (*Paspalum dilatatum*) in the Island of Guam. — BRIGGS, C., in *Guam Agricultural Experiment Station, Bulletin* No. 1, pp. 1-44, tables 15, pl. 6. Washington, Dec. 2, 1921.

Most native forage gramineae in Guam have a low feeding value.

For the last 10 years, the Guam agricultural Experiment Station has made a series of trials with native grasses in the feeding of livestock work, and have proved the necessity of replacing these grasses by imported gramineae of superior quality, such as Para grass (*Panicum barbinode*), and Paspalum (*Paspalum dilatatum*). Both these grasses are adapted to Guam conditions, being very vigorous growers during the wet season, and on the other hand, possessing special drought-resistant qualities (particularly the paspalum) which render them valuable during periods of exceptionally dry weather.

*Panicum barbinode* was introduced into Guam by the Agricultural Experiment Station in May 1910 from the Hawaii Agricultural Experiment Station, where it had been introduced from the Fiji Island in 1902.

It is a coarse grass with prostrate runners; the stems grow upright when the ground is fairly covered with grass, and the plant reaches a height of 2 to 15 feet. It forms a good pasture grass if carefully laid down. It is readily propagated by seeds, roots, cuttings and by whole stalks. High yields are obtained on lowlands, and these may be increased by the application of farmyard manure or fertilisers. Livestock eat the grass readily.

Both *Panicum barbinode* and *Paspalum dilatatum* should be well established before they are used as pasture. Para grass will support one animal per acre of grass the whole year round and Paspalum can support much heavier grazing.

*Paspalum dilatatum* was first introduced into Guam in 1909 by the Experiment Station. Seed was obtained from the United States Department of Agriculture. Paspalum is a perennial having a deep fibrous root system, and is a bushy grass when not sown too thickly. It is propagated by seeds or cuttings, but preferably by root cuttings planted 1 foot apart. It is especially suited for pasture and gives a good yield for at least 9 months of the year.

It is adapted to a wide range of soils but grows best on rich and moist lowlands; it will however thrive on comparatively poor and rocky soils. It is estimated to pasture at least 1 to 3 animals per acre all the year round when grown on fairly good soil.

Each of these grasses has an excellent feeding value and a high protein content, 16.30 % average for *Panicum barbinode* and 14.9 % for *Paspalum dilatatum* (air dried).

F. D.

1055 - Forage Sorghums. — VINALL, H. N. and GATTY, R. E. (Office of Forage Crop Investigations, Bureau of Plant Industry), in *United States Department of Agriculture, Bulletin* No. 981, pp. 1-68, figs. 25, bibliography of 20 works. Washington, December 21, 1921.

Sudan grass was introduced into the United States from Africa in 1909, and from the one bag or eight ounces of seed has come practically all the Sudan grass now being grown in the country. The crops sown

increase every year; the value of the 1918 crop was estimated at over 10 million dollars. Sudan grass is to-day grown successfully in Australia, South America, the Philippines, Hawaii, Porto Rico and Cuba.

The plant is now technically known as *Andropogon sorghum sudanensis*, although it was originally introduced from Africa under the name of *Andropogon halepensis*, which belongs to a nearly related species, Johnson Grass (Aleppo sorghum), which differs from it in the possession of rhizomes. The latter form is confined to the Mediterranean basin, while Sudan grass is peculiar to Central and South Africa (see appended map, p. 1236).

*A. halepensis* is much grown in the Southeastern States of the Union, but it lacks the forage qualities possessed by *A. Sorghum sudanensis*.

The latter is known under several other names, of which one is *Holcus Sorghum sudanensis* (Piper) Hitchc. The author gives a botanical description of the plant and establishes its relationship with closely allied forms, nearly all of which are of African origin. Among them may be mentioned: Tunis Grass (*Andropogon sorghum virgatus* Hack [Piper] — Kamerun Grass (*A. S. effusus* Hackel) — Tabucki Grass (*A. S. verticilliflorus* Stendel) — Chicken Corn (*A. S. Drummondii* [Nees] Hackel, or *Holcus Sorghum Drummondii* [Nees] Hitchc) — a wild sorghum (*A. S. Hewisoni* Piper). The author also mentions the hybrids, especially Austin's "Johnsorgo", obtained from the cross Honey sorgho × Johnson grass (1).

Sudan Grass does not thrive in a cold climate and cannot be grown to advantage at high latitudes, nor within 200 miles of the Northern boundary of the United States. Excessive heat and moisture such as are found on the S. Atlantic coast and the Gulf of Mexico are, however, also not suitable for this plant as it is subject to the attacks of plant and animal parasites. Under other conditions it produces a more or less good crop, because although it has a high water requirement, it is able to withstand protracted periods of drought and recovers quickly when rain comes. Sudan grass is of most value in an emergency for making hay; it forms good summer pasture and is useful as a soiling crop but is not so suitable for silage as maize or ordinary sorghum. Care must be observed when using it as pasture for cattle on account of the prussic acid it contains.

The author gives information regarding the sowing and harvesting of Sudan Grass, its cultivation as a catch-crop, and when mixed with legumes. He also mentions its diseases and enemies together with the best means for their control.

Sudan Grass seed should be planted about  $\frac{1}{2}$  inch to  $1\frac{1}{2}$  inches deep on moist or heavy soils, and from 1 to 3 inches deep on dry or lighter land. For hay production it is best to drill or broadcast 20 to 25 pounds of seed per acre in the humid regions, and 10 to 15 pounds per acre in the drier portion of the United States.

(1) See R. May-June 1922, No. 534. (Ed.)



For seed production, 3 to 4 pounds of seed per acre are sufficient, drilled in rows 36 to 42 inches apart; the rows should not be too far distant from each other or the roots will develop to an extent that renders subsequent operations difficult. Except in irrigated districts, seed production is now-a-days unprofitable, for the yields are low and the prices uncertain, further there is a great danger of the admixture of Johnson grass seed, and it is practically impossible to separate the seeds of the two grasses by any mechanical means. The author gives the microscopic characters of both kinds of seed. Sudan Grass can easily be crossed with other sorghums. In order to prevent natural crossing, Sudan grass intended for seed production should never be sown on a field which has been under sorghum the previous year, or within 80 rods of other varieties of sorghum. It should not be cut for hay until it has headed, otherwise the yield is much reduced. Sudan Grass dries slowly and must be given plenty of time to cure. Mixed plantings of *A. Sorghum sudanensis* and legumes such as soy beans are profitable only in the more humid regions. The same diseases and insects that attack other sorghums also injure Sudan Grass. *Sphacelothecum sorghi* Link and *Colletotrichum cereale* Manns can be controlled by treating the seed with formaldehyde. Rotation of crops is also very effective. L. V.

1056 - **Experimental Growth of "Ghessab" (*Pennisetum spicatum*) in Sicily** (1). — SCAVONE, G., in *Giornale degli Allevatori*, Year XVIII, No. 2, pp 12-13. Catania, 1922.

After noticing the surprising rapidity of growth of "ghessab" in the crops which he had grown at Bengasi, the writer wished to try it near Syracuse, with sowings on irrigation land. It was sown on the 20th May and mown on the 1st July, leaving along the irrigation furrows the finest plants for seed production; a second cutting was made at the end of July. During the previous autumn the land had been deeply ploughed and manured, and during the winter it was put under beans. The good results obtained are shewn in the following account made out for a hectare:

#### EXPENDITURE.

70 kg. of seed at 2 lire . . . . .	140 lire
6 days ploughing at 40 lire to break up, flatten and furrow the ground for irrigation . . . . .	240 "
22 days manual labour at 10 lire preparing the ground for irrigation, loosening the soil, sowing, making 6 or 7 waterings, 2 being for the second crop . . . . .	220 "
4 daily labourers (at 10 lire) and 6 women (at 5 lire) for mowing, harvesting the part left for seed, and collecting the seed . . . . .	70 "
Rent of irrigable land for 4 months . . . . .	400 "
Cost of after manuring and sundries . . . . .	230 "
<b>Total expenditure . . . . .</b>	<b>1300 lire</b>

(1) See R. July-Aug. 1920, No. 747. (Ed.)

## RECEIPTS.

First crop:—350 qx. of grass at <i>lire</i> 7.50 . . . . .	2625 <i>lire</i>
Second crop:—150 qx. of grass at <i>lire</i> 7.50 . . . . .	1125 "
4 qx. of seed at 180 <i>lire</i> . . . . .	720 "
Pasturage on the 2nd crop and a hundred bundles of grass stalks . . . . .	130 "
	<hr/>
Total receipts . . . . .	4600 <i>lire</i>
Deduct total expenditure . . . . .	1300 "
	<hr/>
Net profit per hectare . . . . .	3300 <i>lire</i>
	<hr/>

The grass stalks are useful for field coverings and specially for nurseries and hot-beds.

By sowing the seed obtained, in the following year, uniform germination was secured but the growth was less luxuriant. However the half field intended for forage gave two abundant crops; on the other hand the half left for seed flowered well but gave a very small amount of seeds, which could not be collected, as when barely in the milky stage they were attacked by swarms of wasps (*Vespa germanica* and *V. vulgaris*) which ate up the whole of the inside. Birds were also very destructive.

The unsatisfactory results of this second experiment are attributed by the writer to several causes:— not sufficiently careful ploughing — lack of manure — cold and wet season — degeneration of the seed; that used in the first experiment had been brought from Bengasi. F. D.

1057 — **Mangolds in Combination with Maize.** — Succi, A., in *L'Italia agricola*, Year 50, No. 8, pp. 265-268, Piacenza, Aug. 1922.

The writer calls attention to the economic advantage of growing mangolds mixed with maize, a combination which he has tried with success for about twenty years. The mangolds are sown between the lines of maize and at the same time or a little earlier. The two plants spring up and grow together; the maize then develops rapidly and the growth of the mangolds gradually slows down until it stops completely; by degrees as the maize begins to ripen the pressure is eased and the mangolds again begin to grow and after the maize is harvested, develop quite normally.

At this time, the beginning of autumn, the soil is the seat of a powerful chemico-biological activity by which the mangolds are able to profit; they leave therefore to the next crop, which is generally wheat, smaller quantities of fertilising principles and especially of nitrogen; it is therefore necessary to make up the deficiency by abundant manuring of the maize when combined with mangolds or by applying a quick acting fertiliser to the wheat.

That there is no danger of the mangolds dying during the suspension of growth has been ascertained by the writer even in the case of its combination with Caragua giant maize, as well as in southern districts with dry summers and in light mellow volcanic soils.



The combination allows for compensation for the damage which in some years drought causes to the maize, for the reduced growth of the maize allows the mangolds to grow larger.

Lastly, the writer gives the appropriate cultural rules:— The soil to be sown should be crumbled; the space between the lines of maize should not exceed or but slightly that of maize grown by itself, e. g. for early Reggio dwarf maize, it should measure 40-50 cm.; no special attention is necessary for the associated crops; weeding and earthing up are done at the same time; the uprooting and transplanting of the mangolds causes no injury to the maize.

Sugar beet is much less suitable for growing with maize; whatever variety is grown the roots can only be used for feeding cattle; it is therefore better to grow mangolds in combination with maize as they give a more abundant crop.

D. F.

1058 - **Olive-Growing in the South-West of the United States.** — KINMAN, C. F. (Pomologist, Horticultural and Pomological Investigations), in *Farmers' Bulletin* 1249, *United States Department of Agriculture*, figs 28, pp. 43, maps 2. Washington, February, 1922.

OIL  
PRODUCING  
PLANTS

Olive-growing in the United States is confined to California and Arizona. It was introduced by the Franciscan Missions about a century and a half ago, and has increased yearly, so that in 1919 the area under olive-trees in California was 15 160 hectares, and in 1917 there were 246 hectares of oliveyards in Arizona.

The United States imported 149 350 hectolitres of olives and 313 740 hectolitres of olive-oil in 1919. Until 1900 California and Arizona both produced olive-oil, but since that date the whole crop of olives has been preserved in the green state, or when ripe. As there are large tracts in the country suitable for olive-growing, the United States would find it profitable to encourage the development of the industry.

The chief centres of olive cultivation are: the Sacramento Valley, the San Joaquin Valley, the coast of Central California, South California and Arizona.

The author describes the climatic and soil conditions etc. necessary for olive-growing.

The varieties grown are not very numerous. The oldest is the Mission variety, but during the last 30 years of the nineteenth century, more than 80 varieties were introduced from Spain, Italy and France. Since no more oil has been manufactured, these foreign varieties have been superseded by others which bear larger fruits.

After the "Mission" variety, the most important varieties are: "Manzanillo", imported from Spain; this tree produces larger and earlier ripening fruit than the "Mission" and is suitable for regions with early frosts; the tree is vigorous and has a spreading habit of growth — "Ascolano" a native of Italy, bearing some of the largest fruits of oval shape produced by the trees in America — "Sevillana" (Spanish) very widely cultivated, with long oval fruits of excellent quality — "Redding" im-

ported from France, much cultivated, being regarded as the true Picholine, with small fruits yielding much oil — "Nevadillo" a somewhat smaller variety than the Mission; the fruits are regular in shape, but not large enough for preserving.

The author describes the various methods of propagating the olive-tree: from seed, slips and grafts — the distances at which it should be planted — the methods of cultivation — pruning — and irrigation.

The date of gathering the crop varies greatly according to the situation of the olive-yard. In the hot districts of California olives can be picked as early as October, whereas in some parts of the coast, they are not harvested before February.

Olives to preserve well must be sufficiently but not over ripe. Although the colour should be a good guide, it cannot be trusted.

Olives are ready for gathering when their pulp contains 17 % of oil, e. g. for the Mission variety. This percentage is reduced to 15 % in the case of "Manzanillo". Other varieties are picked when relatively green.

In order to prevent injury, the fruit is always hand-picked.

As soon as the olives are collected, they are graded by a sorting machine, the fruit of the different varieties being treated separately.

After sorting the fruits are placed in tanks to undergo the treatment necessary for their preservation.

The bitterness of the olives is removed by a bath of potash solution; afterwards they are carefully aerated to give them a dark colour, washed in cold water and left for some days to soak in salt water, after which they are removed from the tanks, placed in bottles of salt water and put in a water-bath or autoclave.

The author describes the diseases and parasites which attack the olive-tree in the United States.

Among the insects is *Saissetia oleae* Bern (black scale), while of the bacteria, *B. savastanoi* (knot), is the most important. Die-back or exanthema, and Dry-rot are two of the most serious diseases encountered in the olive-yards.

P. C.

#### SUGAR CROPS

1059 — **Comparative values of Various Nitrogenous Manures for Sugar Cane Growing, in Java.** — KUYPER, J, in *Archief voor de Suikerindustrie in Nederlandsch Indië*, 1922, *Mededeelingen*, No. 3, pp. 145-154 + 6 diagr. Soerabaja, 1922.

For several years field experiments have been made, under the direction of the Pasoeroean experimental Station for sugar cane cultivation, for the values of several nitrogenous manures. Sulphate of ammonia, the manure in general use, the average dose being 425 kg. per hectare, serves as a basis of comparison.

During the last 10 years 162 comparative tests have been made between sulphate of ammonia and nitrate of soda and it has been possible to shew that for sugar cane these two manures have the same value; sulphate of ammonia however is to be preferred as not being hygroscopic.

Cyanamide of calcium is not equal to sulphate of ammonia; in about

a hundred tests with cyanamide, the sulphate gave an equal result 24 times and 53 times a better result.

A mixture of nitrate and sulphate of ammonia supplied by the "Badische Anilin und Soda Fabriken" proved too hygroscopic, owing to the conditions of the tropical rainy season. Urea, supplied also by the above mentioned firm, gave the same results as sulphate of ammonia with which it was compared in 12 field experiments; it is therefore considered that urea will form a good substitute for sulphate of ammonia. A more detailed examination was made with ground nut cake. This manure showed itself inferior to sulphate of ammonia but it did better in light soils. It is more efficient when combined with sulphate of ammonia. In all the experiments the amount of nitrogen furnished by the different manures was equivalent.

J. K.

1060 — **Use of the Refractometer in the individual Examination of Sugar Beets.** — MUNERATI, O and MEZZADROLI, G., in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. I, V, No. 4-6, pp 163-173 Modena, 1922.

Since 1913, the writer have used at the "Stazione Sperimentale di Bieticoltura" at Rovigo the sugar refractometer to supplement the examination with the polarimeter for the testing of beets for selection. Their long experience thus acquired enables them to report as follows:— the refractometer (sugar type) is very useful for the individual analysis of beets, but it cannot take the place of the polarimeter, except in the case where an approximate idea of the percentage of sugar in the beet is sufficient; the data which the polarimeter and the refractometer give supplement and control one another. The method of examination with the refractometer can replace by reason of its greater accuracy and easier use the method of immersion in a solution of salt or sugar of known density, for classification according to the specific gravity of the roots. The second polarimetrical examination (system of double analysis), which is ordinarily made in selection laboratories to control a preliminary analysis of individuals which have shown a high sugar content, may be replaced by an examination with the refractometer. This method is equally accurate and avoids the risks of spoiling caused by double immersion.

The extra staff and cost entailed by reading the refractometer does not exceed 15-20 % of that which is required for ordinary polarimetrical analyses. The use of the refractometer may be of great value in cases in which it is only necessary to ascertain the density (dry matter) of the juice, or to fix approximately the value of a beet, without making an examination with the polarimeter.

F. D.

1061 — **Chests of Red Cedar (*Juniperus virginiana*) for Protecting Clothing against Damage by Moths (*Tineola biselli* Humme).** — BACK, R. A. (Entomologist in Charge of Stored Product Insect Investigations, Bureau of Entomology) and RABAK, FR. (Chemical Biologist, Drug, Poisonous and Oil Plant Investigations Bureau of Plant Industry), in *U. S. Department of Agriculture, Bulletin* No. 1051, pp. 1-14, bibliography of 18 works. Washington, April 13, 1922.

AROMATIC  
PLANTS ETC.

Red cedar (*Juniperus virginiana*) commonly known as Tennessee or Virginia red cedar, is one of the most widely distributed trees in the

United States ; it is found as far west as the Rocky Mountains, and in Tennessee, Virginia and North Carolina it occurs in large areas of nearly pure forest. It sometimes reaches a height of 90 ft., but usually averages 40 to 50 ft. or less. In general, the red cedar is a straight tree pyramidal in shape. The wood is light, close-grained, compact and durable. The heartwood is red and strongly aromatic (1) while the sapwood is white and odourless.

For centuries chests made of red cedar have enjoyed the reputation of protecting clothing stored in them from the ravages of clothes moths. The authors undertook a comprehensive study of the effect of such chests upon the adults, eggs and larvae of the southern or webbing clothes moth, *Tineola bisellielli* Hummel to see how far these chests were really an adequate protection.

The experiments had a positive result. Chests made of heartwood of red cedar are effective in protecting fabrics from the ravages of the clothes moth if they are beaten, brushed and exposed to the sun before being put away. The authors experimented with 9 chests from the time of manufacture until the chests were 9 years old and are of opinion that they will retain their protective powers indefinitely, if well-cared for. Special precautions must be taken to prevent the chests losing their characteristic odour which is the active factor ; they shut tightly and must be left open as little as possible.

Adult moths can live from a fortnight to a month in the chest and lay their eggs, but as they do not eat and the young larvae promptly succumb, no harm is caused by their presence. On the other hand, larvae 3 to 4 months old continue their development. These larger larvae are capable of doing a good deal of damage, although their powers appear to be somewhat diminished by the effect of the chests. The larger the larvae when they enter the chest, the more resistant are they to the aromatic odour, until they reach an age or size, not easily defined, when they acquire the faculty of feeding and developing normally within the chests.

Larvae hatching from eggs within the chests die in most instances within 2 or 3 days, and practically all succumb within a fortnight. If hatched outside and introduced into the chests in clothing, they soon show a tendency to cease feeding and rarely live over the first or second week. It is important that all goods intended for storage in cedar chests should be cleaned, beaten, brushed and sunned in order to remove or kill as many of the moths' eggs and larvae as possible. Special attention must be given to all seams, creases and pockets. Such clothing, if stored at once in good cedar chests, should be sufficiently well protected.

E. K.

(1) The heartwood contains from 2 to 4 per cent of a pale yellowish-brown volatile oil of which the principal constituents are alcohol cedrol, the sesquiterpene alcohol cedrenol and the sesquiterpene cedrene ; the characteristic odour is probably due to the two former compounds. (Ed.)

1062 - **Belladonna and Foxglove cultivated in the Province of Florence, Italy.** — ALESSANDRI, I. (Laboratorio di Chimica Farmaceutica del R. Istituto di Studi Superiori di Firenze), in *Archivio di Farmacologia sperimentale e scienze affini*, Vol. XXXI, No. 9, pp. 143-144 and No. 10, pp. 145-153. Rome, May 1 and May 15, 1921.

The writer has examined a specimen of *Atropa Belladonna* taken from wild plants at Vallombrosa (950-1050 m.) collected in the months of August and September, which had almost completely fructified, and a specimen taken from 2 year old plants cultivated in experimental plots of the "R. Istituto Forestale alle Cascine" (40 m.), collected in the months of June and July, and obtained by sowing seeds of Vallombrosa wild plants. The quantitative analysis of the alkaloid was made according to the method suggested by CAESAR and LORENTZ. The average of three determinations gave 0.297 % of alkaloid for the first specimen, and 0.192 % for the second; the quantity of moisture was approximately equal for both, viz., 4.66 and 3.95 % respectively. The German pharmacopoea requires a minimum of 0.30 % of alkaloid and consequently cultivation in the plains has provided a drug with insufficient atropine, while the wild plants of the mountain zone could be used for extraction of the alkaloid.

The writer has also examined three specimens of *Digitalis purpurea*. One of them was taken from plants grown at Vallombrosa from imported seed: the other two came from plants cultivated at the "Cascine" after sowing Vallombrosa seed; in one case they were transplanted, in the other not.

A physiological test was made on frogs, applying FOCKE's method, but using a 5 % infusion instead of 1 %. The effect passing from the second specimen to the first and third was in decreasing order, though between the last two there were only slight differences. The coefficients calculated according to FOCKE's formula were, as average of two determinations: — 0.231 — 0.122 — 0.1255 %. The ultimate chemical test made according to the Italian Military Pharmacopoea which fixes a minimum of 0.14, gave respectively the following percentages of digitalin: — 0.322 — 0.150 — 0.181; the three specimens contained approximately the same quantity of moisture (4.0 — 5.87 — 4.54 %). On the whole, the two series of data agree. They indicate that the cultivation of the foxglove is to be recommended and also that wild plants may be suitable. It is however desirable that further researches should be made and supplemented by quantitative tests, to establish these conclusions. L. V.

1063 - **Wormseed (*Chenopodium ambrosioides*).** — BRU, P., in *Revue vétérinaire*, Vol. LXXIV, No. 4, pp. 217-225. Toulouse, April 1922.

Wormseed is a plant with the properties of a vermifuge and specially effective against round worms (ascarids, trichocephali, ankylostomes, strongyli, etc.), and as such, largely used in America. In Maryland (United States) *Chenopodium ambrosioides* var. *anthelminthicum*, which is richer in active principles, is specially cultivated. Plants of this variety are 1 m. high, with stiff stalks, branches covered with hairs, narrow leaves, 5 to 7 times as long as they are broad, pointed marginal denticulation; near the end of the stalk, the leaves are shorter and are finally scarcely visible.

The floral glomerules are collected in closely packed whorls without bracts and form as a whole, a compact terminal cluster. A strong, penetrating aromatic odour is set free from all parts of the plant, due to an essential oil secreted in the hairs and parenchymatous glands. The American variety is replaced in France by *Chenopodium ambrosioides* var. *subfruticosum* very common in the west and south and known locally under the names of Mexican tea, Mexican ambrosia and goose-foot vermifuge. It grows on rubbish heaps and sub-spontaneously with alternate lanceolate leaves, with undulating rather than dentate edges, and wider than those of the American variety; the flowers are greenish and arranged all along the stalk in axillary glomerules. In tropical regions, in Brazil, in the Antilles and in Dahomey a third variety is found — var. *Sancta Maria* which from a pharmacological standpoint, differs from the preceding varieties as these differ between themselves, only in the content of the active principle.

Plants of *Chenopodium* contain a volatile essential oil (essence of *Chenopodium*) composed of ascaridol  $C_{10}H_{16}O_2$  (65 % on the average), cymol (22 %) and dioxyterpen. The active principle is ascaridol. The essence is obtained by distillation of the seeds or the tops of the plant when they have almost reached maturity. The writer describes its therapeutic and other properties.

R. F

#### HORTICULTURE

1064 - Vegetable Growing in Island of Guam. — BRIGGS, G., in *Guam Agricultural Experiment Station, Bulletin No. 2*, pp. 1-66 Washington, June 1922

Before the occupation of Guam by the United States, only a very few vegetables were grown by the natives. Since then distinct progress has been made throughout the island. Nearly all the common vegetables can be grown. However, methods adopted for the various crops in the temperate zone generally require some modification in the Tropics; seeds often fail to germinate or the plants do not yield any fruit.

Owing to the lack of definite information concerning tropical horticulture, the Guam Agricultural Experiment Station has undertaken the development of this work since its establishment in 1909. The methods to be adopted are based on the results obtained and are given in detail in the bulletin under consideration.

Amongst other points discussed are included: suitable soils; seed; manures and fertilisers; preparation of seed-bed; planting; cultivation; fences and windbreaks; diseases and pests; detailed cultural directions for the various crops: viz. acelga (*Beta cycla* and *B. vulgaris cycla*); amargoso (*Momordica charantia*); arrow-root (*Maranta arundinacea*); Asparagus (*Asparagus* sp.); banana (*Musa sapientum*); lima beans (*Phaseolus lunatus*) and variety "chochomeco" etc.; cowpea (*Vigna sinensis*) and variety "fijole"; cerebilla (*Doichos lablab*); seguidilla (*Psophocarpus tetragonoloba*); mungo (*Phaseolus aureus*); maize cabbage; calabaza (*Lagenaria vulgaris*); carrot (*Daucus carota*); cassava (*Manihot manihot* (= *M. utilisissima*); chayote (*Sechium edule*); collards (*Brassica* sp.); condor (*Benincasa cerifera*); cucumber (*Cucumis sativus*); egg-plant (*Solanum melongena*); horse-radish (*Cochlearia armoracia*); lettuce; mint; musk-

melon (*Cucumis melo*); mustard (*Brassica juncea*); okra (*Hibiscus esculentus*); onion; papaya (*Carica Papaya*); parsley; patola (*Luffa aegyptiaca*); peas; pechay (*Brassica chinensis*); peppers; pigeon pea (*Cajanus indicus*); plantain (*Musa paradisiaca*); potatoes; *Cucurbita* spp.; radish (*Raphanus sativus*); roselle (*Hibiscus sabdariffa*); spinach (*Spinacia oleracea*); sweet potato (*Ipomoea Batatas*); taro (*Colocasia esculenta*); tomato; turnip; water melon (*Citrullus vulgaris*); yam (*Dioscorea* spp.); yam bean (*Pachyrhizus tuberosus*).

F. D.

1065 — **Cultivation of Citrus Fruits in Rhodesia.** — TURNER, A. G., in *Department of Agriculture, Salisbury, Rhodesia, Bulletin No. 124*, 23 pp. Salisbury, June 1922.

ARBORICULTURE

During the last 5 or 6 years, great progress in citrus fruit cultivation has been made in several parts of Rhodesia. The great problem to be solved is that of transport; in 1921, only part of the consignments received at the various ports could be shipped. The author advised co-operation amongst the growers as being the best means of overcoming the difficulty, and in the first half of 1922, a co-operative Society was founded known as the "Fruit Growers' Exchange of South Africa, Ltd." In spite of the lack of tonnage in 1921, about  $\frac{1}{3}$  of all the citrus fruit exported that year by the whole Union of South Africa (240 000 cases), came from Rhodesia and the exports this year are expected to be twice as large.

The average prices fetched by Rhodesian oranges in 1921 were as follows: — wholesale price in England 23 shillings per case; in Rhodesia, the price was 16/6 net (i. e. after deduction of the costs of railway carriage and freightage, lading and unloading charges, commission etc.); in the orange gardens, the fruit was sold for 10 shillings per case. These oranges find a ready sale in Europe, for they come on the market at a time when other oranges are not available.

One case of first-class fruit can be obtained from an orange tree 5 years of age, while the crop of a tree in full bearing, viz, when 10 years old, will fill three or four cases.

The author studies the following questions: choice of locality — selection of varieties, the following being recommended as being most in demand by the export trade: Washington Navel — Valencia Lale — Jaffa — Joppa — Mediterranean Sweet — Paper Rind St. Michael; the two first being special favourites — planting an orange garden — irrigation — cultivation — manuring — pruning — spraying and fumigation.

F. D.

1066 — **Vine-Growing in Alsace.** — BURGER, G., in *Progrès agricole et viticole*, Year 39, No. 23, pp. 544-548 Montpellier, June 3, 1922.

VINE GROWING

The area cultivated under vines in Alsace is 20 000 ha. The production is somewhat variable, being 725 000 hl. in 1920 and 368 850 hl. in 1921, and white wines are estimated to make up 90 % of the total production.

Alsatian table wines are distinguished according to the vines. Ordinary wines are produced by: — Bourgeois, Chasselas, Kniperlé, Silvaner. They resemble German Moselle wines. Fine wines come from the vines:

— Gentil, Riesling, white Pinot, Traminer, and resemble the German Rhine wines. The most famous districts are:— Ribeauvillé, Riquewihr, Ammerschwiler, Mittelwihr, Hunawihr, Beblenheim, Turkheim, Eguisheim, Rouffach, Guebwiller in the Upper Rhine; Barr, Kinzheim, Dambach, Molsheim, Obernai in the Lower Rhine.

The wines of Alsace are characterised by fine bouquet combined with a pleasant acidity and are of a mellow type. These good quality wines represent a new class for France, the Alsatian wines bring of a different character from the French.

Their cost is generally high, owing to the amount of manual labour required for production. Alsatian wines must therefore try to take the place of the old German wines in the market, mainly in the markets of Paris, Belgium and England.

P. C.

#### FORESTRY

1067 - **Mangrove Swamps in the Dutch Indies.** — BECKING, J. H., DEN BERGER, L. G. and MEINDERSMA, H. W., in *Tectona*, Vol. XV, No. 7, pp. 561-611, 2 figs., bibliography of 22 publications. Buitenzorg, July 1922.

In the Dutch Indies, mangrove swamps are found on the coasts which are less exposed to the open sea such as those of the bay, delta and internal seas and especially on more or less muddy lands subject periodically to sea water flooding. It is not known exactly whether the mangroves improve the fertility of the soil, and they are probably only a secondary factor. Various morphological and physiological characters result from these conditions. SCHIMPER called the mangrove xerophytic because of the high saline concentration which the plants must endure and of their low moisture evaporation. However HOLTERMANN and Von FABER proved that transpiration could be considerable so that SCHIMPER's theory is not entirely accurate.

The swamps in which the mangroves grow and their periodic submersions render special organs of transpiration necessary and these are generally represented by the roots. The pneumatophores are roots or portions of roots which are transformed and provided with organs of transpiration or lenticels.

Many species are viviparous. The seeds germinate on the tree and take root when they fall into the mud. They can float for a long time without sinking in the water like the fruits of non-viviparous plants. The number of species is limited. In the Malay archipelago there are reckoned to be 28 and conspicuous among them are *Rhizophora*, which grows on the sea coast, *Bruguiera* and others which grow in the interior and on less marshy land.

The writer also gives indications for identifying the species of mangroves. He describes the various genera, indicating their chief properties and describing the wood as it appears under an ordinary pocket lens.

The descriptions are summed up diagrammatically in 10 tabular statements containing respectively:— 1) the diameters of trees of normal growth — 2) a list of the values of the various timbers according to the scheme of classification of the Buitenzorg experimental forestry station —



3) the method for determining the wood with the use of a pocket lens — 4) a list of the values of the various woods as fuel — 5) a classification of fuels — 6) a tabular statement for determining the wood — 7) a tabular statement for determining the fuel — 8) the working of the fuel in the Dutch Indies — 9) a tabular statement of the tanning qualities of mangroves — 10) a tabular statement for valuing tanning barks.

By means of a few examples, the writer shows the importance of the exploitation of tanning barks in the Malay archipelago and furnishes information regarding the manufacture of cutch. The commerce in mangroves is done on a large scale but with systems which are not yet economical.

A. d. B.

1068 — **Wooden Chests made of *Juniperus virginiana* for the Protection of Insect Attack on Clothes.** — See No. 1061 of this Review.

## LIVE STOCK AND BREEDING

1069 — **The Screw-Worm Fly (*Cryomyia macellaria* Fabricius) and other Diptera parasitic on Stock in the United States.** — BISHOPP, F. C., MITCHELL, G. D. and PARMAN, D. C., in *United States Department of Agriculture, Farmers' Bulletin* 857, pp. 3-19, figs. 7. Washington, January 1922.

HYGIENE  
OF CATTLE

The screw-worm fly occurs from the extreme southern part of South America northward into Canada, but it seldom becomes abundant in the Northern States being chiefly found in the warmer parts of the Union (Texas, Oklahoma, New Mexico, Arizona and Southern California) where it causes enormous losses to the stock raisers. The various stages of the insect are so well known that it is unnecessary to describe them.

The fly appears (according to the latitude and the season) from the first of April to the middle of June.

The insect decreases in numbers in July and August unless the weather is cloudy and rainy, but again becomes abundant in the early autumn, its activities only ceasing with the heavy frosts. A warm humid atmosphere is best suited to its development.

*Chrysomya macellaria* breeds in decaying matter, especially the carcasses of large animals, and if these could be disposed of properly, no cases of infestation of living animals would occur. Practically however all animals are more or less subject to attack and it infests in decreasing order of frequency cattle, hogs, horses, mules, sheep, goats and dogs. Numerous cases of the infestation of human beings have been recorded.

The eggs are deposited in the wounds of living animals and the young larvae, as soon as they hatch out, burrow into the flesh of their host excreting an irritating substance that breaks down the tissues and may result in the general poisoning of the system. Sometimes calves are attacked at the time of birth when the worms penetrate the navel. At a later stage, infestation takes place by way of the mouth occasionally resulting in loss of teeth or in death. Generally the flies are attracted by coagulated blood, and infestations occur after surgical operations

(castration etc.) or after serious attacks of other parasites (ticks, horse-flies etc.). In severe cases, where there are an enormous number of larvae, the host loses appetite, becomes emaciated and hides in the undergrowth. While fatal cases are not infrequent, most of the loss is due to the reduction of flesh, the expense entailed in treating the animals and the money spent on screw-worm medicines.

**CONTROL MEASURES.** — The best method of control is the burning of any dead animals; this not only stops the breeding of all blow-flies, but prevents the dissemination of dangerous diseases e. g. anthrax, black-leg and hog cholera. The method of burning the carcasses depends to some extent upon the locality. It is desirable that the carcasses should be burnt on the spot, and in cases of anthrax this is essential. If burning is impracticable, the carcasses may be buried beneath at least 2 ft. of closely packed soil. Should it be absolutely impossible to burn or properly bury a carcass, many of the maggots may be destroyed by exposure to the sun.

**PREVENTIVE MEASURES.** — Even in the most heavily infested districts, losses from screw-worm at calving time can be largely avoided by arranging for the cows to calve between December 1 and the middle of April. In the northern regions, this time may be extended from about November 1 to June 1 (1). Branding and castration should be carried out between December 1 and May 1; greater care should be taken in handling the cattle, and the de-horning period ought to be shortened. As supplementary measures, the following may be advised *a*) the destruction of ticks; *b*) the clearing of the brush and undergrowth; *c*) the use of poisoned bait and traps for the destruction of the adult insects.

**TREATMENT OF INFECTED ANIMALS.** — It is important that herds should be watched carefully during the screw-worm season. Those familiar with the injury caused by the parasite can easily tell if a wound is infested, for there is usually a free discharge of watery blood and the wound appears as if recently caused. For destroying the larvae in a wound there is nothing better than chloroform; a deep lesion should afterwards be cleaned out with water containing 5 % carbolic acid; tannic acid followed by pine-tar or some of the creosol dips being afterwards applied as a repellent for flies.

Although only the larvae of *Chrysomya macellaria* penetrate the sound tissues of living animals, the maggots of the black blowfly (*Phormia regina* Meig.) and of the green-bottle fly (*Lucilia sericata* Meig.) infest the wool of sheep while those of the flesh-fly (*Sarcophaga* spp.) attack suppurating wounds.

The above three species are carrion breeders and only when very numerous do they infest wounds on living animals; the best means therefore of controlling them are those already recommended in the case of *Chrysomya macellaria*.

E. F.

(1) This would of course mean a change in the present practice of leaving the bulls with the herd continuously. (Authors' Note)

1070 - **Splenic Inflammation of Pigs in Prussia and the Causes of its increased Frequency.** — WIEMANN (Reg. und Veterinärarzt, Berlin), in *Berliner tierärztliche Wochenschrift*, Year XXXVIII, No. 15, pp. 169-171. Berlin, April 13, 1922.

In 1912, ELSÄSSER and SIEBEL (1) called the attention of breeders to the rapid and extraordinary increase in cases of splenic inflammation of pigs in Prussia; the same year the Prussian Ministry of Agriculture and the Imperial Bureau of health caused researches to be made regarding the causes of the increased frequency of this disease; they made a careful microbiological examination of anatomical material taken from 238 cases. These are classed by the writer in 4 groups (according to the gravity of their anatomopathological injuries and the diffusion of the germs) and tabulated according to their origin.

Regarding the origin of the disease, it was evident that it should be looked for in the foods given to the animals and especially in those coming from foreign countries. The latter in fact formed a very considerable portion of the food of the pigs, especially in Hanover and Schleswig-Holstein, because in these countries the fattening of pigs had increased to such an extent that the local production of barley was insufficient for the feeding requirements and it was in those districts that cases of the disease were most frequent.

Subsequent researches indicated fish meal ("Fischmehl") as the probable vehicle of the pathogenic germs, a food consumed in large quantities, because it was cheap and at the same time considered to be very nourishing; however under normal conditions, it proved to be free from bacteria. It was then thought that the fish meal might be adulterated by the addition of substances containing the germs of splenic inflammation, and sufficient evidence was soon collected to detect bone meal of Indian origin ("indisches Knochenmehl"). The Prussian Government ordered extensive investigations to be made to ascertain definitely: — (a) whether the fish meal was manufactured in infected localities, and how it was made — (b) whether other matter was mixed with the fish meal either at the place of production or in trading, and if so, the nature of that matter — (c) whether foreign or only local fishmeal was ordinarily found on the market and whether the foreign meal was sold to the public after undergoing special manipulation or mixture with other products. These enquiries led to a definite result: among the numerous samples sent in for examination at the Institute of Hygiene at the Veterinary College at Berlin, a large percentage of samples of fish meal contained bone meal, which in almost all cases contained germs of the disease.

It was then ascertained, both in Prussia and in other States of the Empire, that certain large manufacturing firms constantly adulterated the fish meal with considerable quantities of Indian bone meal and it was understood that the danger of this product was already known by the Governments

(1) ELSÄSSER and SIEBEL, Ueber die gesundheitpolizeiliche Beurteilung des Fleisches bei lokalem Milzbrand bei Schweinen, in *Zeitschrift für Fleisch u. Milchhygiene*, 1912, No. 8-9. (Author's note)

of the United States and of New Zealand, who had prohibited its importation. Another proof of the fact that the increased frequency of splenic inflammation in pigs was due to the adulteration of the food with bone meal was afforded during the war, which prevented the importation of this product:— the number of cases of the disease which was, for the whole of Germany, 2706 in 1914, fell to 112 in 1915, to 133 in 1916, to 34 in 1917 and to 30 in 1918. E. F.

# ANATOMY AND PHYSIOLOGY

1071 — **Experimental Contribution to the Knowledge of the "Working Conditions" of Draught Animals under different Dietary Conditions.** — ALBERTONI, L. in *Le Stazioni sperimentali agrarie italiane*, Vol. LV, No. 4-5-6, pp. 173-262, bibliography of 46 publications. Modena, 1922.

Work done at the Royal College of Veterinary Medicine at Bologna.

After a wide review of present knowledge on the subject of the influence of different rations on the "working conditions" of draught animals, the writer describes his experiments on this question.

The following points are considered:—

I. — VARIATIONS OF THE PERCENTAGES OF GLYCOGEN AND OF GLUCOSE IN THE MUSCLES OF THE FRAME AND OF GLYCOGEN IN THE LIVER, UNDER THE INFLUENCE OF DIFFERENT DIETS. — 1) *Importance of glucose and glycogen for muscular contraction.* — 2) *Quantities of glucose and glycogen which may be found in the animal organism.* — 3) *Quantities of glucose and glycogen which may come from the ration* : how much of them the ration should contain in order to supply them again to the muscles. — 4) *Origin of the glucose of non-nitrogenous extracts and of crude cellulose* — 5) *Origin of the glucose of proteins and of fats.* — 6) *Summary on the capacity of the ration of herbivorous animals to supply glucose to the muscles* : "The rations of our herbivorous animals in which for hygienic and economic reasons, carbohydrates always predominate, should be such that they are able to maintain in the muscles the maximum quantity of glycogen which they can contain if, apart from the chemical relationship of simple foods to glucose, other causes which may influence that formation do not intervene." — 7) *CHAVEAU'S theory on the production of work.* — 8) *State of nutrition of animals and their provision of glycogen.* — 9) *Method of research followed in these experiments.* According to CHAVEAU'S theory on the production of work:— 1) Glucose is the immediate food of the intramuscular combustion of work — 2) Glucose can be derived from carbohydrates, albumens, and fats — 3) The food materials replace one another by isodynamic weights.

CHAVEAU considered glucose as being derived from fats by incomplete oxidation and from albumens by hydrolysis with the formation of decomposition products unutilisable as plastic material. In each case there would be a loss of energy, but the numerous and conclusive experiments of ZUNTZ, of his collaborators ATWATER and BENEDICT and other scientists lead to the conclusion "that, in the development of force nutritive substances replace each other in proportion to their provision of utilisable energy."

The experiments of the writer do not relate to this question "except

from the practical stand point, at least, it may be considered as solved, " but to the choice of foods for the production of work.

He proposed to determine " which are the foods that enable an animal to return the total output of work that may be expected from their composition; which are, in short, the foods which will best maintain an animal in a condition for work and by what means they may be able to influence it. " In these experiments the animals had been kept resting and well fed, sometimes even *ad libitum*.

II. — PROBABLE CAUSES OF VARIATION OF THE PERCENTAGE OF GLYCOGEN IN THE MUSCLES.

III. — 1) *Choice description and analysis of foods.* The writer used :— pasture, grass hay (almost exclusively of *Dactylis glomerata*), lucerne, oat grain, beans, maize, rice, barley; as protein food, Emmental cheese; as fatty food, lard) — 2) *Composition of forages, such as is determined by analyses and its importance in regard to these researches.* — 3) *Choice of animals, their preparation for feeding experiments, distribution of rations, observations regarding the behaviour of the animals.* — 4) *Methods employed for the quantitative analysis of glycogen in the muscles and in the liver, and for the quantitative analysis of glucose in the muscles.* For glucose :— extraction of the muscle by repeated boiling, filtration of the broth, defecation with excess of nitrate of mercury, filtration, precipitation of the reagent excess by a current of sulphuretted hydrogen, filtration, neutralisation and concentration of the liquid, quantitative analysis of glucose according to ALLIHN'S method; for the determination of glycogen PFLÜGER'S method was used.

IV. — DESCRIPTION OF THE EXPERIMENTS : — 1) on horses — 2) on rabbits — 3) on guinea pigs — 4) on white rats.

The results of experiments made on the horse and the mule are summed up as follows : — 1) The ration of pasture grass and oats produced a greater quantity of muscular glycogen than the ration of pasture or of oats alone. — 2) the diet composed only of grass hay and straw given in sufficient quantity for the nourishment of resting animals, produced very much less glycogen in the muscles than the maximum which could be found in them. — 3) The addition of oats and rice to the maintenance ration, composed of grass hay and straw, considerably increased the amount of muscular glycogen — 4) Oats and rice, each given in proportion to the nutritive units which they contain, produced in the horse and the mule different quantities of glycogen. — 5) The semi-tendinous muscle of the horse and the sterno-humeral examined on the same animal and at the same time showed a remarkable difference in the percentage of glycogen : 23.5 % more in the former than in the latter. — 6) The mule did not reach the percentage of muscular glycogen of the horse fed on the same ration; the latter exceeded the mule by about 68 %. — 7) A horse kept on pasture only at first, and oats only afterwards, showed a negligible difference in the quantities of glucose contained in the semi-tendinous muscle (3.88 and 3.66 per 1000 respectively).

V. — 1) *Influence of the percentage of protein in the ration on the pro-*

*duction of muscular glycogen*: from most of the experiments made up to the present, it results that the protein ration, especially if it is not deprived of carbo-hydrates, is favourable to the production of glycogen — 2) *Nitrogenous foods in the practical feeding of working animals.* — 3) *Conclusions regarding the influence of the quantities of proteins in the ration on the sources of muscular energy.* — 4) *Foods rich in carbo-hydrates.*

Casein renders the muscles of rats rich in glycogen: the fat in which it was administered and the excellent state of nutrition of the animals, did not prevent the deposit of a considerable amount of glycogen in the muscles. Using other protein foods ROSEMBERG and MERING got the same results, while SEITZ, with ducks overfed with albumen, found the glycogen reduced to traces and replaced by fat: apparently, it may therefore be concluded that proteins do not all behave in the same manner for the production of the two principal substances of muscular reserve. "It remains to be ascertained experimentally whether it is necessary to make a distinction between the proteins which produce glycogen in the muscles and those which produce fat, or whether the formation of fat in the liver and the corresponding disappearance of glycogen are produced when proteins alone are fed continuously in large quantities, so that an alteration of the chemistry of the hay may result.

Decrease in the quantity of carbohydrates to the advantage of proteins in the ration of herbivorous animals in no way hinders the production of glycogen (which is largely assured by the rest of the ration); it is even favourable to it in an indirect manner, for a large quantity of protein in the ration insures to the protoplasm of the muscular fibres the maximum power of accumulating reserve substances. Abundant feeding does not always cause, by the fattening it entails, a decrease of glycogen in the muscles. The diet of rice produces, both in the muscles and in the liver, a large quantity of glycogen, so long as the percentage of protein in the ration does not decrease below what is sufficient to balance the nitrogen requirements of the animal, or so long as it is maintained above that limit. It may even happen that foods with a carbohydrate basis, well known to be producers of glycogen (those for example, which are composed essentially of barley, maize, sugar, and probably also those with potatoes, chestnuts, carobs, foods with wide nutritive ration) do not produce glycogen in the muscles because they are insufficient to maintain, in the muscular fibres and in the circulation of the muscle, the reserve which maintains the turgescence of the cells, and which is very probably the necessary condition to enable the muscular protoplasm to preserve, to a high degree, the fundamental metabolism, the power of elaboration and the faculty of accumulating non-nitrogenous energetic substances. It is thus explained how rations in which carbohydrates predominate may be less suitable than protein rations for the production of sources of muscular energy and consequently of work, in cases of serious impoverishment in nitrogen of the whole organism, *e. g.* race horse in the period of training, acclimatisation crisis, breeding season, etc. In all these cases, eggs, meat, dried blood may prove the best restorers of strength and may be preferred.

VI. — (1) *Probable causes determining the difference of production of muscular glycogen between diets composed of carbo-hydrates, and applications to the technology of work, resulting from that difference of behaviour.*

The experiments of the writer lead to the conclusion that common foods have different physiological values. Using the results obtained with rats and making the productivity of muscular glycogen from rice equal to 100: barley was 100 — cheese 72.4 — maize 69.00 — oats 57 — lard 44 — beans 32.75. The quantity of muscular glycogen which is found in animals subjected to various diets compared with an equal quantity of glycogen of the liver is distinctly different: high in a rice diet (10.2 — 13.54 %) and still higher in a cheese diet (14.8 — 41.30 %) and a diet of bacon (26 %), it falls to 9.2 — 6.17 % in a diet of oats, and to 8.2 — 6.4 in that of beans. If the physiological values of several foods are considered we reach "the surprising fact that the rations universally preferred for working animals are the least suitable for producing glycogen in the muscles": thus oats and beans produce less glycogen than rice and barley. "We are therefore led to admit that an animal may be in full possession of its strength while having but little glycogen; and it may be in an excellent state of nutrition without having its maximum reserve of glycogen. The writer considers that diets rich in carbo-hydrates such as were largely given in his experiments, were sufficient to maintain the animals in an excellent condition of nutrition, although they were poor producers of glycogen, and gave muscles rich in fat; those, on the other hand, which have favoured the production of glycogen, gave muscles less rich in fat.

2) *Working condition of draught animals fed with rations producing different quantities of glycogen.* — "Generally it may be said that glycogen favours the functional efficiency of muscular tissue and that, by assuring the greatest rapidity of chemical, functional and restorative reactions, it favours in that way the rapidity of contraction".

3) *Importance of the quantity of reserve substances in the muscle for the working condition of animals.*

4) *Frequency of contractions and provision of oxygen in the muscles.*

5) *Of different working conditions in which the muscle may find itself under the influence of diet which is to be preferred?*

Should the formation of glycogen or of fat be preferred in the muscle? In other words should we prefer respectively feeding with a basis of barley, rice, sugar, carobs, or with a basis of seeds of leguminous plants, or again a diet of oats, the action of which is intermediate between those of the other two diets?

The muscle which consumes fat, for an equal quantity of energy used, gives the same out put as the muscle which consumes glycogen; and besides, fat accumulates in the muscles in greater quantity because it is deposited as such; glycogen combines with 2 or 3 times its weight of water; fat has, further, a calorific power equal to 2.4 times that of glycogen.

If therefore we consider the problem of the sources of muscular energy from the sole standpoint of the amount of energy, the feeding of the animals should have as basis the use of substances forming muscular fat.

But glycogen has a very peculiar signification for the optimum output of the muscles and for sudden muscular contraction; it may apparently, be said that, when sufficient glycogen can be accumulated in the muscle for accomplishing a required work (the work not being very prolonged or else the animal having the power to store glycogen in large quantity), it is rational to procure its formation. When the work is intense and difficult for the means at the disposal of the animal a diet permitting the formation of a sufficient quantity of glycogen should also be chosen. Lastly, the choice of a food producing a large amount of glycogen might also be rendered necessary by hygienic reasons, for example to maintain a higher percentage of moisture in the tissues. Consequently the choice of the food will depend: — 1) on the intensity, the duration and the nature of the work — 2) on the aptitude of the animal to store up one or the other reserve substance; that faculty depends on the species, race (among horses the Eastern races and their derivatives tend to store up glycogen more especially whereas draught breeds store up fat), climate, sex, etc. — 3) on other factors which determine the working conditions, such as temperament and the quantity of haemoglobin.

6) Some of the specific effects on the working condition of animals, attributed to foods, find their explanation in the results of these researches  
F. D.

#### FEEDS AND FEEDING

1072 — **Rules for Feeding Cattle.** — SCARAMUZZI, D. in *Le Stazioni sperimentali a riarie italiane*, Vol. LV, Nos. 4-5-6, pp. 109-124. Modena, 1922.

In order to give rules to the farmer who neither wishes to waste forage nor to make unintelligent economies, the writer, using mean analytical data contained in the treatise by Professors MENOZZI and NICCOLI, *L'alimentazione del bestiame*, has calculated the percentage proportions of different foods to be used, so as to obtain a ration the nutritive ratio of which decreases successively from 1 : 4 to 1 : 2.

As foods, he has taken into consideration those which have the greatest importance for southern Italy, that is to say all the mixtures which it is possible to form by combining two of the following feeds: — clover hay — vetch hay — straw of cereals — bran — oats — carobs — beans — refuse of olives — husks of grapes — linseed cake.  
F. D.

1073 — **Use, as Cattle Food, of certain Waste Products from Chick-peas, Peas and Beans.** — LAY, C. (R. Stazione chimico-agraria di Torino), in *Le Stazioni sperimentali a riarie italiane*, Vol. LV, No. 4-5, pp. 125-128. Modena, 1922.

CHICK-PEAS. — Of the numerous varieties of chick-peas grown in Italy, some have seeds with hard teguments, so that they must be decorticated for use as human food. Such are the chick-peas with black or red tegument, grown especially in the Province of Bari (annual Italian production 7000-8000 q.) and prepared for use in Piedmont with modern machinery. From these peas are obtained about 75 % of endosperm ("cicerata") and 25 % of waste material from decortication, composed about half of tegument and the rest of endosperm. The waste material is used as cattle food either as it is or mixed with bran or with milling refuse.



For sheep, these waste materials are generally first moistened ; to horses they are fed dry ; for young pigs, they should be ground very fine. Price : — wholesale 79 *lire* the quintal ; retail 90-95 *lire* the quintal.

From the analysis of two samples of decortication waste, one of black chick-peas and the other of red chick-peas, the writer obtained respectively the following percentages :— Hygroscopic moisture by drying at 100°, 11.90 — 10.76 ; Proteins ( $N \times 6.25$ ), 5.25 — 6.20 ; Ash, 5.24 — 5.28 ; Crude fats, 0.42 — 0.95. Cellulose, 27.86 — 25.10 ; Nitrogen-free-extracts, 49.33 — 51.71 ; Pentosans, 15.81 — 14.90.

The ash contained :— Calcium oxide 46.29 — 45.30 ; Potassium oxide 26.52 — 25.38 ; Magnesium oxide 16.08 — 16.98 ; Phosphoric acid 2.66 — 3.02 %.

BEANS. — On decortication in the machine, the beans yield 68-74 % of endosperm and 26-32 % of tegument with a loss of about 2 %, whereas by hand about 85 % of endosperm and 15 % of tegument are obtained. The decortication waste of beans with the machine contains therefore about one half endosperm waste ; the price is the same as for the chick-pea waste. Percentage composition of the endosperm and of the teguments respectively :— Moisture 11.81 — 12.43 ; Proteins ( $N \times 6.25$ ) 27.81 — 9.25 ; Fats 1.53 — 0.21 ; Cellulose 3.02 — 30.15 ; Ash 3.53 — 2.85 ; Nitrogenous-free-extracts 52.30 — 45.11 ; Pentosans, 4.50 — 4.28.

PEAS. — Decortication in the machine gives 55-60 % of cleaned seed (endosperm) and 40 — 45 % of tegument, against 80 % of endosperm and 20 % of tegument by hand decortication. The price of the decortication waste is the same as in the case of chick-peas. Percentage composition of the endosperm and tegument respectively :— Moisture 11.05 — 11.15 ; Proteins ( $N \times 6.25$ ) 23.62 — 7.18 ; Fats 1.24 — 0.75 ; Cellulose 1.35 — 29.73 ; Ash 2.76 — 3.00 ; Nitrogenous-free-extracts 58.98 — 48.19 ; Pentosans, 4.96 — 19.58.

CONCLUSION. — The waste products of decortication by machine of chick-peas, beans, peas constitute excellent cattle foods, as they consist, to the extent of about one half of fragments and flour of the internal part of the seed (endosperm). F. D.

1074 - **Improvement of Stock Breeding in Morocco.** — VELU, H., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. VIII, No. 26, pp. 736-740. Paris, 19 July 1922

The improvement of stock breeding methods in Morocco depend mainly :— (a) on the possibility of increasing the herds — (b) on a definite aim in breeding, in order to specialise in the production of cattle, pigs and sheep — (c) on the choice of methods to be adopted to obtain the necessary improvements in quality.

The great factors which are outside human control and which must be taken into account at the outset and in the course of the work, are essentially the climate and the parasitic organisms or carriers of disease. As in all hot countries, environment is of the greatest importance. Diseases,

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even the gravest and the most common, are largely dangerous because they attack animals which the climate has reduced to a state of bad health and vital exhaustion. In Morocco animals die mainly of hunger in summer, of hunger and cold in winter (1).

The organisation for the control of numerous internal and external parasites is also a factor of essential importance. Preventive measures against external parasites are almost exclusively based on arsenical dips: the writer therefore advises that the sale and use of soluble crude arsenical products should be allowed in Morocco. The control of internal parasites, which is more difficult, requires the adoption of enclosed areas and the removal of stock from pastures in order to interrupt the cycles of development of parasites which have no intermediate hosts and to destroy these hosts when they exist.

In conclusion, breeding in Morocco, depends on the organisation of preventive measures against disease and modification of the environments which favour the development of parasites. The improvement of environment is an economic problem, for it is a case of ascertaining whether extensive breeding is possible in Morocco or whether it must be replaced by semi-stall rearing. The control of parasites is further a problem of colonial policy, for, to put it into practice, the hostility of the natives must be overcome.

E. F.

#### CATTLE

1075 - **The Work of the Central Syndicate for the Exportation of Charolais Cattle.** -

HITIER, H., in *Bulletin de la Société d'encouragement pour l'industrie nationale*, Vol 134, No 7, pp. 617-621 Paris, July 1922.

The Charolais breed of cattle which is particularly common in the Departments of the Allier, the Cher, the Indre, the Loire, the Nièvre and Saône-et-Loire, is considered to be one of the best breeds. Shortly after the end of the European war, the local breeders, with the object of making their produce known abroad and to induce cattle-breeding countries to use them to improve their herds, constituted a federation of the various agricultural societies and syndicates of the above-mentioned Departments. This federation adopted the name of "race charolaise" as official title, and grouped in a single "Herd-book of the Charolais breed for the Nièvre, Saône et Loire and adjacent Departments" the local genealogical books which had been founded since 1887. They formed subsequently the "Syndicat d'exportation de la race charolaise" as an agency to study the means of establishing relations with foreign markets and to undertake the sale of breeding animals.

The publication reviewed is a report on the work of this Syndicate, which first printed and distributed a propaganda pamphlet, accompanied

(1) Drought, the high cost of forage, the brackish water given for drinking, cause collectively chronic and often fatal digestive troubles. The syndrome which results forms the subject, from a strictly veterinary standpoint of another publication by the writer. (Summer-autumn mortality and its relationship with the influence of environment in Morocco, in *Revue de Zootechnie*, No. 9, pp. 897-900. Paris, June 1922, which reproduces, in part, the considerations which have just been related above). (Ed.)

by photographs and translated into several languages, and it next took into consideration the necessity of sending to the countries of export a number of breeding animals selected with a view to attract the attention of breeders. Owing to the assistance of several private breeders, the Syndicate was able to overcome initial financial difficulties and it at present, is dealing with the inoculation of some breeding animals destined for Brazil and other South American States, where *tristeza* (piroplasmosis) is raging.

E. F.

1076 - **The Identification of Cattle by Means of Nose-Prints.** — PETERSEN, W. E., in *Journal of Dairy Science*, Vol. 5, No. 3, pp. 249-258, figs. 6, Baltimore, May 1922.

The various breeding associations have always been confronted with a serious problem in the proper identification of animals for registration and of animals on official test. All other means having proved unsatisfactory, O. H. BAKER, of the American Jersey Cattle Club, suggested using nose-prints for the purpose. The author describes the method of taking the prints and the best way of identifying the prints so obtained. The most satisfactory results were given by mimeograph news-print paper and black stamping-pad ink. From different tests made with some 350 cattle the author drew the following conclusions: 1) no two animals have identical pattern nose-prints, therefore these prints will enable positive identification; 2) the taking of nose-prints is simple enough to be practical; 3) it is possible to identify prints as being of the same animal, even if they are not perfect; 4) the pattern remains the same through life; 5) this test is practical for the identification of cows on official test and may prove valuable in connection with the registration of all solid colour cattle; 6) the method affords a positive means of identification when claim for loss is made under livestock insurance policies. F. S.

1077 - **Studies on Reproduction of Cattle.** — I. GRAU, A., L'âge de la reproduction chez l'espèce bovine, in *Revue de Zootechnie*, No. 9, pp. 869-880. Paris, June 15, 1922. — II. MAC CANDLISH, A. C., Studies in the Growth and Nutrition of Dairy Calves, in *Journal of Dairy Science*, Vol. V, No. 3, pp. 301-321. Baltimore, May 1922.

I. — **THE REPRODUCTION AGE IN CATTLE.** — While it is indispensable, in a well managed breeding establishment, to breed from the best animals, it is also necessary to consider at what age breeding should take place.

**Bulls.** — From what age in the life of the animal and up to what age should a bull serve? About the age of 2 years service may take place almost daily without harm, but the number of cows which one bull can serve would be fifty or sixty at most. It is only very vigorous bulls reaching their third year who can annually serve as many as 80 or 100 cows. Also if service takes place during part of the year only it will be necessary to reduce the number of cows which the bull can cover. This is why in the case of an important herd the proportion of one bull for every 50 cows is desirable.

It may be profitable to replace a full grown bull by a younger bull, a year old, which will grow and which will pay for its keep by its increased value while growing. The advantage of retaining the full grown bull is

that its capacity is known whereas that of the young bull is not, however good may be its appearance.

It would be a serious economic error to apply strictly to the male breeding animal the famous doctrine of making use of cattle during the period of growth. That idea may be extended to oxen kept almost up to 4 years old for beef or else for working up to 4 or 5 years and then to be fattened.

The bull however is the founder of the herd and should be kept as long as possible from the time that it becomes a source of improvement. It is possible to maintain a bull in good breeding condition if it is allowed to run in the fields at times, instead of being kept always in a stall. Should this not be possible, the bull when full grown ought not to be over-fed or it will become too fat.

Hay would form a suitable basis for a ration with a few oats as an addition, but no cake should be given. If it is desired to obtain strong, healthy animals in the herd, it is absolutely necessary to pay close attention to the food of the selected bull, increasing it when young so that the bull may grow up quickly but restricting it from the age of about two years and a half so that the animal may not become too fat.

*Cows.*— For cows the breeding age is, so to say, the inverse of that for the males. Would it be profitable to make cows calve as early as possible in their second year or would it be better to await the third year? The writer quotes good reasons urged by partisans of both methods. In his opinion the best rule for breeding is that under which the animals are free in their movements and have plenty of fresh air.

Moreover grass is often considered the ideal food and with it the essential function of the organism will be best accomplished, the blood will be richer and development will be better assured. The young cows should be suitably fed and should go out to pasture to the greatest extent; there would certainly not be any harm in arranging that they should have their first calf between the ages of 28 and 30 months. In the case of dairy cows, not only would one calf and one period of lactation be gained, but their subsequent yield would be increased.

Cows belonging to a dual-purpose breed should not have their first calf until about 3 years old. In the special case of a select herd, there may also be occasion not to send to the bull before 18 months but to wait for 6 or 12 months according to whether it is a question of a dairy breed or not. Certainly better animals would be obtained and better qualities might be developed.

The writer advises that good bulls and cows should be kept as long as possible, and that the inferior animals should not be retained for breeding.

II. — STUDIES IN THE GROWTH OF DAIRY CALVES. — 1) *Duration of gestation.* — The variations of the period of gestation have hitherto been little studied. The writer quotes researches made on this subject by SPENCER, WING and FLEMING and the conclusions drawn from their observations. He himself made experiments in order to ascertain: — the influence which the age of the cow at the time of bulling and the season during which bulling took place might have on the duration of gesta-

tion: the relationship which exists between the sex of the calf and the duration of gestation, and the influence which the age of the cow may have on the latter. These observations, made on 369 gestations, led the writer to conclude:— 1) that the average period of gestation in dairy cows is 280 days — 2) that this duration is not variable according to breed; 3) that the sex of the calf does not appear to have any influence on the duration of gestation — 4) that the proportion of male and female calves was about equal — 5) that on the average 82.6 % of the calves remain from 271 to 290 days in the uterus — 6) that the age of the cows at the time of bulling was without influence on the duration of gestation — 7) that gestation was not influenced by the season in which bulling took place.

2) *Weight of calves at birth.* — The writer relates the work done on this subject by HEVARY & MORRISON and ECKLES. According to the researches which he made personally on the subject: — 1) of the influence which the age of the cow at the time of bulling might have on the weight of the calf at birth — 2) of the relation between the weight of the cow at the time of bulling and that of the calf at birth — 3) of the influence of the season during which bulling took place on the weight of the newly born calf — 4) of the influence of the duration of gestation on the weight of the calf — the writer concluded: — 1) that the average weight of calves at birth was 32.65 kg for males, 29.47 kg for females and 31.29 kg for all the calves — 2) that among pedigree calves, the heaviest were Holsteins, next Ayrshires, Guernseys and Jerseys — 3) that on the average, at birth the weight of calves of no special breed is the lowest, that of pure bred calves is the highest and that of half-bred calves very nearly the same as that of pure-bred calves — 4) that the average weight of newly born calves increases with the age of the cows, until the cows reach the age of 5 years, after which the weight of the calves decreases in an irregular manner — 5) that increase in the weight of the cows denotes an increased weight of the calves; this increase however is not directly proportional to that of the cow — 6) that possibly calves born between the months of April and October may be lighter than those born during the rest of the year; there are however considerable variations in the weights of calves born in the two periods — 7) that the duration of gestation has little influence on the weight of the calf; on the other hand, the nearer the duration of gestation is to the normal, the nearer the weight of the calf is to the normal weight, while their weight at birth increases when the duration of gestation deviates from the normal.

(3) *Rate of growth of dairy heifers.* — After referring to the researches of ECKLES, WATERS, MAC CANDLISH and ROBERTSON, the writer describes the method which he adopted in his researches on this subject. From his experiments he draws the following conclusions:— 1) Apparently there are few cases of loss of weight after calving — 2) The live weight of the animals increases most rapidly — 3) According to body measurements, it appears that the dimensions of breadth, depth, and height follow one another in the order of the rate at which they increase — 4) There seems to

be little difference between calves born in winter (that is to say between the 1st October and the 31st March) and those born in summer (from the 1st April to the 30th September), except that the heifers born in winter attain, at the time when bulling commences, higher weights and bodily proportions than those born in summer — (5) There seems to be a sufficiently distinct relation between the live weight (expressed in kg) of the animals and the product of their heights, depths and breadths (expressed in cm.).

D. S.

1078 — **Some Results of Reeding Milch Cows at Experiment Stations in the United States.** — WINTHERS, S. R., in *Heard's Dairyman*, Vol. LXIII, No. 12, p. 419, figs. 4. Fort Atkinson, Wis., April 7, 1922

Dairy cattle feeding experiments are being conducted at the 5 Stations of the Dairy Division, United States Department of Agriculture with the threefold object 1) to ascertain the productive capacity of cows and their ability to maintain weight when their ration is deprived of grain; 2) to ascertain the profitableness of feeding grain to milch cows; 3) to study the production of milk, butter, etc.

The author mentions results already obtained on these points: A Holstein (Helen Nilkje Calamity) made a creditable record, although from the age of about 8 years she was given no grain, her ration consisting of roughage alone. On lucerne hay, maize silage and pasture grass this animal yielded 470 pounds of butterfat in one year. The following twelve months, the same ration supplemented with a liberal ration of grain was fed to the cow with the result that the milk and fat production were respectively 25 499 and 823 pounds.

As regards the economical results of feeding roughage exclusively, varying conditions have to be taken into account. In dairy districts where the product is sold on a butterfat basis, the increased production due to the addition of grain to the ration might not yield much return; on the other hand, where the produce is marketed in the form of milk, the investment in grain might be very profitable. The author gives other instances of good records of Government cows kept at the above-mentioned Stations of the Dairy Division.

E. F.

1079 — **Comparison of early, medium and late maturing Varieties of Silage Maize for Milk Production.** — WHITE, G. C., CHAPMAN, L. M., SLATE, W. L., and BROWN, B. A., in *Journal of Dairy Science*, Vol. IV, No. 4, pp. 333-347, fig. 1. Baltimore, July 1922.

The experiment made by the authors is an attempt to determine the relative economy of milk production by growing early, medium or late varieties of maize for silage.

The varieties used to represent the 3 types were early, Pride of the North, Medium, Leaming; late, Eureka. The researches were carried out at the Storrs Agricultural Experiment Station (Connecticut, United States) upon Holstein, Jersey and Guernsey cows of ages varying from 2 ½ years to 10 years and 10 months.

It was found that late-maturing varieties, under favourable conditions,

are decidedly superior in yield to the early varieties, both as regards total tonnage and dry matter. The following five years averages were obtained for green maize: early group, cut at hard dough stage, 24 774 lb. per acre, water content 73.80 % — medium group, soft dough stage, 32 947 lb. per acre, water 78.09 % — late group, kernels just forming, 40 648 lb., water 80.16 %.

Pride of the North contained 25.74 % dry matter in silage; Leaming 25.17 % and Eureka 19.43 %. It must however be remembered that the season allowed Leaming to mature more than usual, so that the crop used in the feeding tests had practically the same percentage of dry matter as Pride of the North and gave very similar results.

The cows were fed silage as well as hay and a grain ration, the latter consisting of maize + wheat bran and cotton seed meal (3 : 3 : 2) having a nutritive ratio of 1 to 3.8 and carrying 14.8 % digestible protein and 71.71 % digestible nutrients. The hay consumed was 4 lb. per head and per day.

The feeding trial proper lasted 100 days, after a preliminary feeding first upon regular herd silage, and later on the experimental silage.

The amount of silage consumed per day by each group was as follows 1st group (early maize) 44.977 lb — 2nd group (medium) 45.739 lb. — 3rd group (late) 45.537 lb. The amount of dry matter furnished by the silage per day to each group was respectively 11.232 lb. — 11.519 lb. — 9.081 lb.

The grain was fed in proportion to the weight of the animals, the object being to keep them at a uniform weight. By this plan, most of the food was used for maintenance and production, a very small amount contributing to the development of the foetus in early gestation. The average daily consumption of grain was 9.972 lb. by the early group — 8.314 lb. by the medium and 11.604 lb. by the late.

The following Table gives a summary of some of the most important data.

	1st group	2nd group	3rd group
Average daily milk yield. . . . .	lb. 28.286	22.938	29.206
" " fat " . . . . .	lb. 1.0878	1.0455	1.0788
Total daily solid yield . . . . .	lb. 3.5769	3.1578	3.5990
Average initial weight . . . . .	lb. 1054.4	963.3	1046.8
Average increase (+) or loss (—) in live weight in 100 days . . . . .	lb. + 17.64	+ 22.33	— 14
Grain consumption per 100 lb. milk (1) . . . . .	lb. 35.405	35.816	39.780
Grain consumption per 1 lb. solids in milk. . . . .	lb. 2.752(2)	2.593	3.249

(1) The relatively high grain requirement per unit of production for all the groups is due to the small hay allowance.

(2) The better record made by group 2 in solids production is due to its lesser maintenance requirements.

The results thus show a saving for 100 pounds of milk of 4.37 pounds of grain for the group fed early maize as compared with the group given late maize. Ton for ton these data seem to indicate the greater economy of the early silage. This is further emphasised by the fact that the group given early maize gained a little in weight, whereas the group fed late maize lost slightly in weight.

F. D.

1080 - **Quantity of Feed consumed by a Heifer from time of Birth to Lactation Period.** — See No. 1095 of this *Review*.

#### GOATS

1081 - **The Goat as an Economic Factor.** — CRÉPIN, J., in *Le Lait*, Year II, No. 5, pp. 313-320. Lyons, May 1922 (1)

Goats are divided into three main fundamental racial branches. The most important has its original home on the great central plateau of Asia ; next comes the group of African races which has its habitat in the Abyssinian Mountains ; lastly the European branch has its origin in the great block of the Alps. Long hair and a light iris are characteristic of Asiatic origin ; very short, silky and glossy hair on a coat of bright, vivid colour, and dark flashing eyes, indicate African origin. The goat in Europe has undergone such deep racial changes that its ethnic characteristic is no longer of serious interest for most breeders. However, in the massif of the Saint Gothard, a goat has been discovered which may be regarded as exemplifying the morphological unit of its species in the required degree. It appears in many varieties of coat, but has in all cases precisely the same economic value. It bears the stamp of a group of races which is necessarily that of the European goat, and of the typical European race. This breed is the largest and the coat is short haired and habitually of many colours, white being only found in cases of albinism. The coats of the Alpine goat are characterised by dull tints, generally shading off from black to tawny and from tawny to light through all shades of grey. The spots are marked in streaks on a ground which, at the extremities of the body, on the belly and the limbs is lighter in colour or is accentuated by a darker shade. A dark stripe often covers the whole length of the spine. The forehead of the Alpine goat has, in profile, a frontal boss. There is, also, near the muzzle, a small swelling indicating a good feeder. According to the writer, it is a mistake to think that there is one goat of the plains and another of the mountains. However, as regards pasture, it does well only in high regions. The most surprising fact in the biology of the goat is that this animal, which seems naturally intended to live in a wild and primitive state of life is admirably adapted to a diet absolutely different from that what appears to be its natural diet. Thus when abundantly fed it gives double the amount of milk which it would give normally.

Under the influence of good training, the lactation of the alpine goat can be prolonged over two years without interruption. The fact is all the more remarkable that an animal capable of supplying 6-7 and even 8 litres of milk per day at the height of its lactation draws this consider-

(1) See : R. 1913, No. 1062 ; 1916, No. 205 ; 1918, No. 794 ; 1921, No. 83. (Ed.)



able mass of milk from a reserve of live substance the weight of which barely exceeds 60 kg. with 6 to 7 kg. of blood. The writer adds that this animal, which reaches maturity only at 4 to 5 years of age, is able to produce young from the age of one year and remains fertile till over the age of 20 years. It is even economically advantageous to profit by its precocity, for if made to produce when very young, its milking power increases and its appetite increases to enable it to meet the double physical expenditure, viz., that required for production and that for growth. The writer does not attach any value or economic importance to the horns, or to the colour of the coat for which the Swiss pseudo-races are recommended. He also notes that it is now possible, by simple measures of cleanliness etc. completely to conceal the peculiar flavour of goat's milk. If therefore goat's milk is no longer distinguishable in taste from best cow's milk and if also malodorous he-goats need no longer be kept in the herds, the writer no longer sees that there can be any reason to object to the use of dairy goats in the food services. In this connection the diffusion of an improved race of goats may be a matter of high importance. Its use on a large scale would greatly improve the diet of children and invalids and would provide a powerful element of control of tuberculous infection. Without claiming that the goat has in itself a concrete principle which immunises it against the microbe, it is possible to assert that the goat never contracts tuberculosis spontaneously. There is a pseudo-tuberculosis which attacks goats exposed to damp cold, but the milk cannot exercise its physiological properties in the organism of the newly born or invalids unless it is administered raw and in its integral form and properties.

The goat is the only animal which can supply children and sick persons with milk in this ideal form. The writer recommends the diffusion of the only European goat, which appears to be not only the authentic thoroughbred of the European race, but also the heaviest milker of the species. It is this race which should be improved by selection and have its excellent qualities established.

F. S.

1082 — **The Pasturing of Pigs.** — DIFFLOTH, P., in *La vie agricole et rurale*, 11th year, Vol. XXI, No. 29, pp. 57-61. Paris, July 22, 1922 (1)

PIGS

The pasturing of pigs is a practical and advantageous method, which in certain countries, gives extremely valuable results. Pigs however owing to the nature of their digestive organs make a poor use of cellulose but economic considerations permit a reconciliation between theory and practice. With a system of pasture for well kept pigs, and a judicious use of supplementary green crops there is very little need of dry foods, for months at a time and the result is a valuable economy. In spring and at the beginning of summer pigs get a supplement of dry foods. In autumn also, when the sows litter and until the young pigs are weaned,

(1) See: R. 1912, No. 374 — R. 1914, No. 1153 — R. 1915, No. 942 — R. 1916, Nos. 889, 1104 — R. 1917, No. 836 — R. 1921, Nos. 1033, 1260 — R. 1922, Nos. 193, 296, 460, 617. (Ed.)

a little grain is indispensable for the ration. The Americans adopt as a practical rule the giving about  $1\frac{3}{4}$  litres of grain per sow each day as a supplement. At every other period, the pastures suffice and assure the best profit. Grain, if obtained economically, will always be valuable, as also cotton and ground nut cakes.

The pasturing of pigs is specially indicated in regions which contain large areas of clearings and of unenclosed woods. In America wooded lands are beginning to be used largely for maintaining pigs in spring and at the beginning of summer, when pasture crops are scarce. The ground-nut then supplies the change required for completing the fattening of the animals. This method costs little for the production of a pound of meat, but with the rapid increase in the production of pigs, breeders have had to examine more closely the phases of this method of rearing and to make various pastures utilisable in all months of the year. The result has been the establishment of several systems of crop rotation. The principal profitable forage crops grazed by pigs are:—

1) *Oats and rye*. — Both are much appreciated as green forage in every farm rearing pigs. Some breeders sow a large stretch of oats, letting the whole be grazed up to the 1st March, then one part is enclosed to be grazed up to June while the remainder is left to ripen. This plan is to be recommended, as it assures pasture at a season when economical food is scarce. Moreover it allows the regulation of the portion reserved for grain according to the actual resources of the farm. Needless to say, the plot which is intended to furnish grain should not be "too closely" grazed if it is desired to avoid a serious falling off in the grain crop. Certain winter oats grow again vigorously after having been grazed and stand pasture well.

2) *Turnips*. — It is especially from January to May that turnips are a valuable resource; earlier or later, other food resources in full yield become available. Two judicious sowings of turnips will cover the difficult period.

3) *Millet*. — Its qualities are much appreciated, and it has the great advantage of providing food at the beginning of spring, at a time when cheap feeding is difficult to find. Sown early, in March, it may be grazed towards the middle of April. It is well to graze the plant early to make it tiller. Millet is a quick growing plant, capable of feeding many pigs for each unit of area. When young this forage is liked by the pigs; but it should not be allowed to become woody. If grazed up to the last, millet will be available up to the middle of July. With three sowings arranged in series in March, April and May, the period of grazing can easily last up to September.

4) *Sorghum*. — Is often sown in alternate rows, sometimes with millet. Sorghum stands grazing worse than millet and if browsed down to the ground, it suffers much. Even thus the young millet as being more tender is preferred and sought out by the animals, which gives the sorghum time to grow and reach a height at which its consumption is profitable and its resistance more assured. These two plants therefore sup-

plement each other and give variety to the feeding. Sorghum can also be used as a green food.

5) *Early Maize*. — Planted in spring it may be grazed or cut about the middle of July. Some breeders grow it alone, others in alternate rows with ground nuts. When the maize is cut green the pigs on pasture will eat the ground nut on the spot and this method gives an earlier fattening food. If it is desired to have at disposal a useful food as early as possible, early varieties of maize are sown, with early horse beans broadcasted between the rows of maize. On heavy soils the horsebean may be replaced by the dwarf kidney bean.

6) *Ground nut*. — Ground nuts fatten pigs at very small cost. Two varieties are grown for pigs:— the North Carolina, or African ground nut, sometimes called the Georgia groundnut, and the Spanish groundnut. The former is a large cropping variety, Planted early in spring, it begins to produce in the middle of September and gives an abundance of good food up to January and even March. It will fatten, without supplement, 7 to 10 pigs per ha. Planted early, the Spanish groundnut. is ready for pasture in August, 6 weeks earlier than the Carolina variety, at a time when "finishing" food is scarce. Its yield is much less, according to certain growers. Although groundnuts supply a rapid fattening and pigs make remarkable increases in weight, they should not be fed exclusively with them for a period of more than 60 to 90 days; otherwise digestive disturbance would be caused. Sows with young should only be allowed to feed among the groundnuts with caution.

F. S.

1083 — **Distribution of Enzymes in the Alimentary Canal of the Chicken.** — PLIMMER, R. H. A. and ROSEDALE, J. L. (Biochemical Department, Rowett Research Institute for Animal Nutrition, University of Aberdeen and North of Scotland College of Agriculture), in *The Biochemical Journal*, Vol. XVI, No. 1, pp. 23-26 London, 1922.

POULTRY  
BEARING

Lactase has so far never been found in the intestine of chickens. The authors fed chickens from hatching for a period of over three months with a ration containing lactose and noted its assimilation. Assimilation of disaccharides is usually preceded by hydrolysis to monosaccharides, and as this would imply the presence of lactase, the authors made an examination of the different parts of the digestive system to discover where the lactase was to be found. Their experiments confirmed the fact that it is absent from the intestine but a small amount was detected in the pancreas, the crop and the gizzard. They then extended their investigations to 8 other enzymes specifically concerned in the digestion of the common foodstuffs and obtained the following results:

The distribution of the sucroclastic enzymes corresponds for the most part with that in the animal, diastase and lipase are generally present in the pancreas of animals; on the other hand there are differences in the distribution of the proteoclastic enzymes; the animal has trypsin acting in alkaline media, the chicken in both alkaline and acid media. The enzyme of the proventriculus, which in the chicken corresponds with the stomach of an animal acts only in acid medium.

	Crop	Proventriculus	Pancreas	Intestine whole	Duodenum	Illum	Caecum
Invertase . . . . .	o	o	.....	+	.....	.....	o
Diastase . . . . .	+	o	+	+	.....	.....	+
Lactase . . . . .	+	o	.....	o	.....	.....	.....
Lipase . . . . .	.....	.....	+	.....	.....	.....	.....
Proteoclastic enzymes in media	o	o	+(slight)	o	o	o	o
neutral	+	+	+(less rapid)	+	+	+	o
acid . . . . .	(rare)	+	+	+	+	+	o
alkaline	o	o	+(rapid)	+(rare)	+	+(rare)	o

E. F.

## BEE-KEEPING

1084 - Insulating Capacity of Double-Walled Bee-Hives. — PHILLIPS, E. F., in *United States Department of Agriculture, Department Circular* 222, 10 pp Washington, May 1922.

The great number of double-walled bee-hives on the market, where they find ready purchasers among bee-keepers by whom they are largely used, has given rise to considerable discussion as to their comparative merits. In order to decide the question, the author carried out a series of experiments and obtained the following information:

The shape of the hive has a considerable influence upon its insulating power, and therefore upon its capacity for preventing loss of heat and protecting the bees from winter cold. The heat escapes most readily from the bottom and the insulation of the walls and top is never so complete as to prevent a large amount of heat from being dissipated.

Bee-keepers however never trouble about the insulation of the bottom of the hive, as they are under the impression that the heat escapes through the top. It is a mistake to uncover the front of the hive, even if it faces south, for if any part of the hive is left with only a single wall, or without some other means of protection, all the efforts made to keep the rest of the hive warm are to a great extent nullified.

In the double-walled hives on the market the heat escapes so readily from the bottom, that little is lost through the roof and still less through the walls.

An air-space left between the two walls does not retain the heat as well as a layer of some material that is a bad conductor, especially if the interstices are very small. Convection currents which dissipate the heat are doubtless always present in the dead angles of the cavity of the hive. The board forming the ceiling should extend as far as the external wall upon which the roof rests. It is more effective to close the double wall only, than merely to shut the opening of the hive.

A thicker layer of insulating material should be used than is generally the case. If sawdust is used, the layer ought to be 10 to 15 cm. thick.

F. D.

1085 - "La Loque" (*Bacillus alvei*) a Bee Disease. — CHEVILLOTTE-MEVEL, O., in *L'Apiculteur*, Year LXXI, No. 8, pp. 270-272. Paris, Aug. 1922.

This disease is caused by a special bacillus (*Bacillus alvei*), a distinct species, according to the writer, but capable of assuming different forms dependent upon its degree of virulence and the nature of environment in which it develops. The therapeutic treatment may also be preventive, and consists in the use of antiseptics (salicylic acid, mixture of carbolic acid and tar, formaldehyde, naphthol  $\beta$ , etc.). The writer was only able to get incomplete results by using antiseptic syrups, which have no effect on larvae already infected.

The best and most scientific prophylactic method is permanently to disinfect the hive with formic acid or 10 % solution of formol; to do this, paraffin wax should be smeared on the insides of several tin boxes (the lids of blacking boxes may be used) to a depth of 1 to 1.5 cm. and they should be filled with the following mixture:— Formic acid or commercial formaldehyde, 2 parts — Alcohol, 1 part — Water, 6 parts. These tins are placed in the hive and the mixture is renewed every week. Generally 3 or 4 doses are enough; sometimes, however, it is necessary to prolong the treatment. E. F.

1086 - Sericulture in Libya. — FORLANI, K., in *Bollettino della R. Stazione Sperimentale di Gelscoltura e Bachicoltura di Ascoli Piceno*, Year 1, No 1, pp. 23-30. Ascoli Piceno 1922.

SILKWORM  
REARING

Breeding of the domestic silk worm was started at Bengasi in 1915 and gave fairly good results. On the initiative of Prof. DE CILLIS (Director of the Agricultural Bureau of the Government of Tripolitania) the breeding of other silk producing insects (which might find in Libya the conditions of environment necessary to their existence) was tried successively, these being:— *Philosomia arrindica* (which lives on the castor oil plant), *Attacus bombinia* of the Sudan (which can live on *Ziziphus*), *Attacus cynthia* (which lives on the *Ailanthus*) and *Attacus cecropia*; but the results were negative.

Breeding of domestic silkworms continues to increase as shown by the following Table:—

Years	Kg. of fresh cocoons	Kg. of dry cocoons	Unit of price	Gross yield
1916	400	135	18	2 430
1917	1 200	400	30	12 000

The propagation of the mulberry tree is under Government control: 2671 plants were distributed in 1916 and 9743 in 1917. In spite of various ailments, which sometimes rage in the broods, it is not uncommon to find in properly built premises productions of 75 kg. of fresh cocoons per ounce of eggs.

According to DE CILLIS (1), MAZZOCCHI-ALEMANNI and LEONE,

(1) DE CILLIS, E., Cinque anni di sperimentazioni agrarie in Tripolitania, *Agricolt. Colon.*, XV, No. 6. (Author's note)

the second fortnight in March is in Libya normally the most suitable time to start breeding, and the premises which are most suitable for native breeding seem to be silkworm nursery huts, partly underground, with walls above ground. For the methods of breeding, suspended sieves, made of local material such as reed grass, palm leaves etc. have proved suitable; for wood, the wild flora are very suitable:— *Brassica Tourneforti* (in arabic "hassluss"), *Pituranthus tortuosus* ("gazzali"), *Raetama raetam* ("rtam"), *Euphorbia guyoniana* ("lebbin"), mid-ribs of the leaves of the date palm, etc. Pure breeds have shown themselves the more likely to give a high quality yield, but are much less resistant to surrounding adverse circumstances, it is thought therefore that the Chinese bi-yellow and multi-yellow crosses are the most suitable breeds.

The silk market of Tripoli at any rate up to a few years ago was almost exclusively supplied with Chinese silk, because owing to the primitive systems of spinning in use the thread of the local cocoons was much weaker than the thread of the Chinese cocoons. The Italian standard most commonly used is 8/100.

Chinese silk coming from Shanghai is classed as follows in the Tripoli market.—

White Steins, blue Phoenix extra.  
Yellow ST, n° 1 yellow Mayung.  
Yellow ST, n° 2       "       "

The silk most in request for making burnous is the yellow silk ST No. 1

The silk-producing industry is domestic and it is ordinarily carried on by the Jewish population (1). E. F.

1087 - Value of Maintaining an even Temperature during the Incubation of Silkworms' Eggs. — ACQUA, C., in *Bollettino della R. Stazione sperimentale di Gelicoltura e Bachicoltura di Ascoli Piceno*, Year 1, No. 1, pp. 13-23. Ascoli Piceno, March 1, 1922

A constant temperature or a slight and gradual rise is recommended for the incubation of silk worms' eggs, and accidental sudden thermometrical changes are considered as very injurious to breeding results: GRANDORI (2) also considers a constant temperature essential, especially during early stages of fertile development. On the other hand, VERNON reports that eggs electrified as soon as they are laid (to cause out of season hatching) may be subjected without injury to temperatures little above 0° and may remain at that temperature for several weeks, and MARTINI has obtained the normal development of eggs treated with hyd-

(1) Information regarding the treatments to which silk thread is subjected in Libya before being distributed to the trade, is contained in an Article entitled "Il Commercio e la lavorazione della seta", published by the *Bollettino d'Informazioni del Ministero delle Colonie* (1921). (Author's notes.)

(2) GRANDORI, M., I problemi vitali della bachicoltura nel momento attuale. Trent. 1921. (Author's note)

rochloric acid and then kept during the summer for several weeks in a refrigerator. The matter is therefore up to the present, a subject of controversy which the writer has tried to settle by proposing to answer the two following questions:— 1) Does a sudden chill during incubation necessarily cause a state of deterioration which may be seen in a higher percentage of unhatched eggs and by irregular progress in breeding? (2) Does this sudden chill produce different results according as it affects different periods of incubation.

Experiments have been made on the following breeds:— indigenous yellow, gold Chinese, white Chinese, Chinese cross ♀ white × ♂ yellow), Chinese cross (♀ yellow × ♂ white), double-strain yellow cross (♀ yellow × ♀ gold), double strain yellow cross (♀ gold × ♂ yellow). In all the cases severe chilling, even when prolonged for several hours (12-24), during incubation, did not produce the disastrous effects which would generally have been expected: there was only a slight increase in the percentage of unhatched eggs and a prolongation of the hatching period, but no injury was caused to the breeding and no decrease of yield as was proved by the average weight of the cocoons of the different lots which were used in the experiments. In reality, there was no contrast, as was only to be expected, between the behaviour of the egg treated for out of season hatching (which is not affected by retardation through chilling) and the behaviour of the egg normally hatched in spring.

It also happens that incubations of indigenous yellow eggs, treated with hydrochloric acid and intended for summer breeding, made at a constant temperature, showed no difference from those exposed to varieties of temperature by day and night, either in the progress of breeding or in the percentage of mortality. During incubation, there was no critical period at which particularly harmful consequences might be caused by a sudden chill; in the different lots of the experiment, the change in temperature was made at very various times and it had, *for all equally*, the same small differences relatively to the control lots. If there had been a critical period, it must have clearly shown its effect by a high percentage of eggs unhatched in the lots which underwent a change on a particular day.

It is easy to see the practical lesson to be derived from these experiments: if an accidental temporary fall in temperature takes place during incubation, the heat in the incubation rooms should not be increased suddenly but gradually.

E. F.

1988 - **Forced Hatching of Silkworms' Eggs with shortened Hibernation.** — I. ACQUA, C., in *Bollettino della R. Stazione Sperimentale di Gelisicoltura e Bachioltura d Ascoli Piceno*, Year 1, No. 1, pp. 3-9 Ascoli Piceno, March 1, 1922. — II. IDEM, *Schiusura estemporanea del seme bachi a ibernazione abbreviata ed esame della pebrina*, *Ibidem*, Year 1, No. 2, pp. 45-48. Ascoli Piceno, June 1, 1922.

The writer has made the two following series of experiments:—

1) On November 21, 1921, he treated with strong hydrochloric acid, for 20 minutes, two lots of silkworm eggs one of the native yellow race the other of double-strain yellow (♂ yellow × ♀ gold) which had up to that

time never been subjected to temperatures below  $15^{\circ}$ . After thorough washing, the lots treated were placed in a refrigerator at  $4^{\circ}$ - $5^{\circ}$  in which they remained for 45 days; they were taken out on January 5, 1922 and subjected to a forced incubation up to  $26^{\circ}$ . On January 17, the first hatchings began; they lasted 6 days and gave the following results for 300 eggs taken at random from the whole of the treated lot and of the control lot:—

	Native yellow	bi-yellow
Treated eggs. . . . .	Hatchings 287	Hatchings 257
Untreated eggs . . . . .	" 7	" 82

These results shew that *the treatment with hydrochloric acid does not cause hatching of old eggs, but predisposes them sufficiently to secure hatching by the help of the subsequent action of cold limited to half the normal time.*

(2) In the second series of experiments, the writer reversed the two stages of the process: a total of 20 samples of native yellow eggs was placed in the refrigerator for 33 days (from November 15 to January 17), then the treatment with hydrochloric acid described above was given and the incubation started. Hatchings took place at the end of January; they were complete and very numerous in the treated lots but very few in the controls. Therefore, *the treatment with hydrochloric acid is as effective before as after hibernation.*

The results indicated by the sentences in italics have great practical importance: it is known in fact that at present, owing to the application of the law regarding the control of silk-worm eggs, they must be subjected to microscopic examination, to insure their being free from pebrine. Technical necessities require that this examination should be made just before hatching; it follows that adding to the period preceding the normal hibernation, the period necessary for examination and for a second contingent examination, a very advanced stage is reached. The material impossibility of carrying out the examination in good time is eliminated by the method adopted by the writer, which reduces to less than half the period of hibernation required and, consequently, gives a practical solution of the problem.

It might be thought that this method hinders the development of the pebrine germs which may be contained in the eggs treated, but this risk is excluded by the researches of the writer, of which he gives an account in the second of the Articles reviewed. In the moths belonging to two sets in series 1) a slight infection of pebrine showed itself; it was thought therefore that the eggs also were partly infected; in fact the examination of the young caterpillars hatched under special treatment contained a slight percentage of infected individuals.

A second and more rigorous test was undertaken by means of two



other series of experiments made one at the beginning and the other at the end of March 1922. The lots in the first series were treated with hydrochloric acid for 15 or 20 minutes, then with electricity for 5 minutes: it was ascertained on the whole that the percentage of cases of infection with pebrine was slightly decreased by the action of the acid. On the other hand the electric treatment caused no differences in the control lots. The lots of the second series, treated with hydrochloric acid only, differed in no way from the control lots; the writer therefore thinks that the difference in the first case was fortuitous and that it is permissible to conclude that the treatment with acid does not check the development of pebrine in infected eggs. E. F.

1089 - **On the Relation of Pebrine Infections in Bombyx Moths and in the Eggs at rest and just before Germination (Expediency and Desirability of Testing a modified Method of preparing Silkworm-Eggs).** — LOMBARDI, L., in *Bollettino della R. Stazione Sperimentale di Gelicoltura e Bachicoltura di Ascoli Piceno*, Year 1, No 2, pp. 48-57 Ascoli Piceno, July 1, 1922.

Ordinarily eggs of the silkworm at rest do not show clearly the pebrine corpuscles but in the case of intense infection some corpusculary eggs are sometimes found even in the state of rest. The writer has examined with the greatest care numerous sets of eggs coming from infected moths and has attempted to establish a certain relation between the degree of infection at the state of rest and that ascertained just before hatching. The work was supplemented by the examination of the moths, which was done in the following manner:— 500 cells, 56 of which contained infected moths, were taken out of a group of yellows which had a considerable percentage of infection (10 %). The test was made by crushing in a mortar one wing with 3 drops of water; a drop of this mixture taken up on a rod was placed between two sheets of glass; the corpuscles found in each space were then counted and the examination of a certain number of spaces gave the average; in the case of certain individuals the corpuscles were too numerous to count and others (where counting was possible) formed a series from 260 to 0.5.

After the examination of the moths, the writer examined the eggs at rest, by crushing for the purpose each egg in a drop of water. After complete hibernation these sets of eggs, were separated and placed to incubate and later just before germination each egg was again examined. The writer examined 100 eggs at rest and 150-200 just before hatching.

A lot of Chinese gold eggs in which infection was less intense were examined: out of 500 sets of eggs, only 39 were infected and there were, as a maximum, 19 corpuscles per space.

The writer gives, in tabular form, the results of these examinations, and draws from them the interesting conclusion that not only the slightly infected moths but also those heavily infected, can furnish sound eggs. In microscopic selection, such as is made by breeders, a certain quantity of sound eggs are therefore rejected, but this must be considered for the present as a necessity of the general method of examination, which it is impossible to change.

The comparisons made between the degree of infection of the eggs at rest and that of the eggs when about to hatch have given results which do not enable any relation to be established between what the microscope reveals in the examination of eggs at rest and in that made at the moment when the eggs are about to hatch. It is not therefore possible to calculate the approximate percentage of actual infection by means of the number of infected eggs found in the former case.

Lastly the writer suggests that in the preparation of the summer eggs and in cases where it is desired to delay hatching by placing the cells in a refrigerator, only cut wings should be included; this method does not in any way prevent the examination for pebrine, since when infection is found in the body of the moth it is always present in the wings; moreover it offers very marked practical advantages, such as the elimination of the putrefiable bodies of the moths and protection against *Dermestes* which often devour both moths and eggs.

E. F.

1090 - **Duration of Virulence of the pathogenic Agent of Jaundice in the Silkworm.** -

ACQUA, C. in *Bollettino della R. Stazione Sperimentale di Gelsicoltura e Bachicoltura di Ascoli Piceno*, Year 1, No. 1, pp. 10-12. Ascoli Piceno, March 1, 1922.

It is known that the hemolymph of the silk-worm attacked by jaundice shows very numerous polyhedric granules (probably degenerative products), which are very effective in the propagation of the disease on account of their intimate connection with the pathogenic virus. Now as the diseased silkworms when the skin is broken give out blood which is very rich in granules and may contaminate the sieves on which breeding takes place, it is expedient to find out whether the disease can be thus transmitted from one year to another, if there has been no systematic disinfection. The writer has therefore undertaken experiments to determine how long the polyhedric granules can preserve their virulence: in 1920, he obtained an experimental development of jaundice by means of granules collected in the spring of the previous year and preserved without any special precautions: in 1921, the results were positive for other granules collected in 1920 and negative for those of 1919. It is therefore clear that infection is easily transmissible from year to year, by means of sieves or other contaminated material, while in the second year virulence appears to be extinct. In any case, rigorous disinfection is absolutely necessary in the districts where jaundice is particularly virulent as for example Campania.

E. F.

**FISH  
BREEDING**

1091 - **Pisciculture in Switzerland in 1921** (1). - *Rapport du Département fédéral de l'Intérieur, in Bulletin suisse de Pêche et de Pisciculture*, year 23, No. 7, pp. 103-107. Neuchâtel, July 1922.

CONFERENCES. - For the first time since 1914, a meeting of the Commissioners of fisheries in Lake Constance, nominated by the adjacent States, took place on September 23 1921 at Friedrichshafen. Among the subjects discussed may be mentioned: - the application of the regulation defining a certain width for the mesh of the bag of the drag net -

(1) See R. Nov. 1921, No. 1152. (Ed.)

the adoption of uniform conditions for the duty on fishing permits for the upper lake — the supervision of fishing in the upper lake — the tax on motor boats — regulations relating to the collection of the fry of the feras, (*Coregonus fera*), etc.

Various questions relating to fishing in Lake Constance, the Lower lake and the Rhine were dealt with by correspondence between the representatives of the interested Governments.

The negotiations with France for the establishment of an agreement regarding fishing on Lake Lemman led to international conferences in the course of which a draft convention was completed. Others were initiated for an understanding regarding fishing in the Doubs.

Progress was also made with preliminary work on the revision of the Italian-Swiss Convention regarding fishing and regulations for its practical working during the year.

FISHING IN LAKE CONSTANCK. — According to the statistics of fishing in Lake Constance (including the Lower lake), Swiss professional fishermen took, in 1921, 175 244 kg. of fish, to a value of 351 439 fr.

SUPERVISION OF FISHING. — For payments to the staff engaged in supervision, the Cantons spent 210 402 fr.; 50 % of which was re-imbursed by the Confederation. For the destruction of animals injurious to fishing the Cantons spent 1251 fr.

A course for fishery guardians took place at Lucerne from the 25th February to the 3rd March.

CONTAMINATED WATER, FISH LADDERS AND SANCTUARIES. — In a certain number of cases the "Département Fédéral de l'Intérieur" intervened with the competent Cantonal authorities to prevent or rectify the pollution of water by factory refuse. The measures to be taken for the protection of fish at the time of construction of factories using water power or other hydraulic works have received special attention. Numerous schemes for the correction of river banks have been prepared. A Bado-Swiss international Commission, was charged with the drafting of rules to be followed in future to improve and utilize the waters of the Rhine between Bâle and Lake Constance.

PISCICULTURE. — During the hatching season of 1920-1921, 218 fish-breeding establishments have been at work. The 176 036 000 eggs hatched produced 136 461 000 young fry including 314 058 summer fry and yearling fish turned out into public waters under official control. The young fry belonged to the following species (in thousands): — salmon (*Trutta salar*) 953 — hybrid salmon-trout 150 — lake trout (*Trutta lacustris*) 2916 — brown trout (*Trutta fario*) 9985 — rainbow trout (*Salmo irideus*) 818 — American grayling (*Salmo fontinalis*) 14 — char (*S. salvelinus*) 3323 — grayling (*Thymallus vulgaris*) 3360 — coregons 100 155 — pike (*Esox lucius*) 14 787.

The Confederation paid over to the Cantons, for division among the fish breeding establishments the sum of 49 060 fr. by way of contributions for rearing and turning out the fry.

Through its Fisheries Department the Government of the United States

made a gift of 50 000 fertilized eggs of the rainbow trout (*Salmo irideus* and of the salmon of the great lakes of North America (*Christivomer namaycush*) to the "Département suisse de l'Intérieur". These will be dealt with in the various fish breeding establishments and used for stocking certain rivers and lakes.

F. D.

#### VARIOUS ANIMALS

1092 - American Moles as Agricultural Pests and Fur Producers. — SCHEFFER, T. H. (Assistant Biologist, Bureau of Biological Survey), in *United States Department of Agriculture, Farmers' Bulletin* 1247, pp. 3-23, figs. 16. Washington, March 1922.

There are in the United States 5 species of true moles: the common mole, *Scalopus aquaticus* found in the plains of the Eastern State — the star-nosed mole (*Condylura cristata*) and the Brewer mole (*Parascalops breweri*) common in the greater part of Pennsylvania, New York and New England, Michigan, Minnesota and to the north of these states — the Townsend mole (*Scapanus townsendii*) of the Pacific Coast States which is the largest of its kind and more abundant locally than any other species and the Gibbs mole (*Neurotrichus gibbsii*), another West coast form, but so rare as ordinarily to escape notice.

The author describes the external characters, specific and differential, of these species, their habits, development, food, natural enemies the damage they cause, means of control, the preparation and utilisation of mole skins. The bulletin is too long to allow more than a brief summary; the following are some of the most interesting and least known facts mentioned.

Contrary to the generally received opinion, the mole does not confine itself to regular periods of work each day (morning, noon and evening), but is equally active at any hour, especially at seasons when there is no great variation in temperature during the 24 hours. Moles are probably never dormant and do not hibernate; they however extend their surface runways at times when soil conditions are favourable, e.g., after rains in summer or during periods of thaw in winter.

Moles grow and develop with extraordinary rapidity.

They are however slow breeders, the number in a litter is commonly 3 in the case of the Townsend mole and 4 with the common eastern mole. The Townsend mole forages in gardens more than the ordinary species.

As regards the supposed natural enemies of the mole, hawks and owls take only a small toll. Poisoned mixtures are of little use, and traps are much more effective. Of these there are many simple types on the market. The trap should be set in runs made in moist rich soil, but no part should project into the cavity, or the moles will burrow beneath it.

Moles may be trapped successfully in the Pacific coast country at any season of the year, and elsewhere when the weather permits. If the trapping is for the purpose of obtaining fur, winter and midsummer are the most favourable seasons, as the pelts are then in the best condition. Care must be taken to use traps that do not tear or damage the skins.

The pelts are classified according to the appearance of the leather

side ; good class skins are of a clear tan colour, while inferior skins are spotted or blotched with bluish-black. Although mole-skins have long been articles of considerable commercial importance, all the pelts used by furriers in America up to about 1917 were obtained through importation from London, the prices paid annually being between 2 and 3 million dollars.

The Bureau of Biological Survey has recently stated that the skins of the common American mole (*Scalopus aquaticus*) are quite as good as the imported skins of *Talpa europaea* while those of the common large mole of Washington and Oregon are of superior quality. Since these facts have been recognised, a local trade in moleskins has arisen and about 50 000 dollars' worth of American pelts were marketed in 1918, and in 1919 the business increased by nearly 25 %. E. F.

### FARM ENGINEERING.

1093 - **Power Farming in Egypt.** — CASORIA, M., in *L'Egypte contemporaine*, Year XIII, No. 62, pp. 80-82. Cairo 1922

AGRICULTURAL  
MACHINERY

In agricultural practice in Egypt, power farming, although its great advantages are recognised, has not spread in proportion to the great extent of land which might be so cultivated ; the reasons are as follows :—

- 1) The net cost is still too high.
- 2) The fact that machines are wanted only for certain work and the delay caused by repairs, owing to the lack of workshops in the districts.
- 3) The difficulty, in certain parts of Lower Egypt, of carrying out power farming owing to the close network of irrigation canals.
- 4) The lack of positive data regarding the net cost, deduced from a test of at least three months uninterrupted work.

The writer concludes that if the manufacturing firms agreed to carry out a definite test, with the approval and assistance of the Ministry of Agriculture, which would make clear the economic and industrial advantages of this mechanical system of cultivation with types of small, medium and large tractors, the result would be convincing, and Egyptian farmers, seeing these advantages, would replace the old methods of agriculture by the mechanical system. G. D.

### RURAL ECONOMY

1094 - **Receipts and Payments in the Cultivation of Ghessab in Sicily.** — See No. 1056 of this Review.

1095 - **The Feed Cost of a Heifer from Birth until the Beginning of the first Lactation Period.** — MC CANDLISH, A. C. (Iowa State College of Agriculture and Mechanical Arts, Ames), in *Journal of Dairy Science*, Vol. V, No. 4, pp. 348-361. Baltimore, July 1922.

Table I gives a summary of the author's previous work in determining the feeds required by dairy heifers grown to the producing age.

TABLE I.

	Authority		
	BENNETT and COOPER	HAYDEN	TEDEMAN
Months fed . . . . .	24	26 1/2	24
Feeds :			
Whole milk, pounds . . . . .	342	459	445
Skim milk, pounds . . . . .	3165	3330	2953
Grain . . . . .	547	1710	737
Dry roughage . . . . .	2649	2634	3145
Silage and soiling . . . . .	3603	4042	2938
Pasture, days . . . . .	294	322	300

The animals used for these experiments which lasted for 5 years, were 40 in number and consisted of pure-bred and grade Holstein, Guernsey and Jersey heifers and pure-bred Ayrshires. Twenty-four of the heifers calved between October 1 and March 31 and were classed as winter heifers; the other 16 which calved between April 1 and September 30, came under the head of summer heifers. In each of these groups, the heifers calved at the average age of 29 "months", the month not being a calendar month, but a period of 30 days.

The average birth weights were 68 lb. for the winter heifers, 64 for

TABLE II. — *Feeds consumed in 29 months (from birth).*

		Cows calved in winter	Cows calved in summer	All the cows
Milk . . . . .	days	3 5	3.5	3.5
Pure milk . . . . .	kg.	690	590	652
Skim milk . . . . .	"	956	991	969
Crushed Maize . . . . .	"	724	673	704
Maize gluten feed . . . . .	"	31	55	40
Crushed oats . . . . .	"	140	118	129
Wheat bran . . . . .	"	229	206	220
Linseed cake . . . . .	"	140	118	129
Linseed cake (crushed) . . . . .	"	15.4	16 3	15.9
Total of concentrated feeds . . . . .	"	1382	1299	1348
Total of ensilaged forage . . . . .	"	1855	2028	1924
Total of hay . . . . .	"	129	158	141
Pasture . . . . .	days	323	368	341
Lucerne hay . . . . .	kg.	1623	1127	1425
Sugar cane forage . . . . .	"	98	99	98.5
Maize forage . . . . .	"	474	493	445

the summer heifers and 67 lb. for all the animals. The average weights at the beginning of the lactation period were 1010 lb., 941 lb., and 982 lb. for the winter, summer and both groups respectively. The average live-

weight gains from birth to the beginning of lactation were 942 lb., 877 lb and 915 lb.

The average daily live-weight gains throughout the trial were respectively 1.09 lb., 1.01 lb., and 1.05 lb.,

The author reckons the feed prices per ton as follows: Crushed maize 10 dollars — hominy feed 20 dollars — Ground oats 15 dollars — wheat bran 20 dollars — linseed oil meal 32 dollars — cottonseed meal 32 dollars — lucerne hay 12 dollars — sugar-cane forage 8 dollars — maize forage 10 dollars — maize silage 4.50 dollars — soiling 4 dollars — whole milk per 100 lb. 2 dollars — skim milk per 100 lb. 0.25 dollars — sucking, per day 0.06 lb. — pasture per day 0.05.

In total feed cost of production, the ranking was: winter heifers, 109.89 dollars; summer heifers, 102.43 dollars, and all heifers, 106.81 dollars each.

The average feed cost per lb. of increase in live weight was 117 cents. in all groups. F. D.

1096 - **Variations in the Cost and Sale Prices of Butter before the War, and from 1913 to 1921, in the United States.** — Ross, H. A. (Illinois College of Agriculture), in *Hoard's Dairyman*, Vol. LXIII, No. 6, pp. 192-193, Fort Atkinson, Wis., February 24, 1922.

The author has plotted curves for the cost price of the fat content of butter with the object of comparing the economic position of butter-producers between 1918 and 1921 with their condition before the War. For this purpose the average amounts of feeds required for the production of one pound of butter were multiplied by the price of these feeds for every month from September 1918 to October 1921. The cost price each month was compared with the price, for the corresponding month for the period 1909-1913. The results obtained were expressed in terms of the 1909-1913 average made up to 100; thus, if for instance the cost price was 200 for any given month, it is double what it was before the War.

If the chart giving these results is examined, it will be seen that from September 1918 to June 1920, the cost price continually increased, reaching during the greater part of this period, a figure double the pre-War average; from June 1920 however there was a rapid fall, which during the last months, brought the prices slightly below those obtaining before the War. This means that the same quantity of the same feeds has a lower value now than just before the War broke out.

The author made a similar chart of the sale prices of butter, comparing the average monthly price on the Chicago market with the quinquennial average of the corresponding months during the 1909-1913 period. This curve (from September 1918 to December 1920) tends to assume the same form as the preceding curve with slight variations in either direction. This result does not indicate that the cost price of the fat was nearly equal to that of the butter, but that the ratio of the cost and sale price was the same as before the War. Thus, if the cost price of the fat was 200, the price of butter was about double what it had been in pre-War days.

As stated above, there was a considerable fall in the cost price of fat between January 1921 and January 1922, whereas no proportional drop took place in the prices of butter. It is however true that the price of butter cannot be regarded as corresponding exactly to the price paid to the producer for the fat; the expenses of handling the butter account for some of the difference between the present and pre-War cost of butter.

Although the cost price varies in each case, the graphic index shows the relative position of each producer and proves that the dairyman who made a profit before the War now makes a higher profit, while any loss, where it occurs, is less, which signifies that the present economic position of the butter producer is better than it was during the 1909-1913 period.

In short, given the present cost of fats and feeds, it is advisable for the dairy farmer to increase the cereal ration of his cows up to the point of obtaining a corresponding rise in the milk yield. E. F.

### AGRICULTURAL INDUSTRIES

#### INDUSTRIES DE PENDING ON PLANT PRODUCTS

1097 - **Composition of Wines of Lees and Lees of Wine.** — SEMICHON, L., in *Comptes rendus de l'Académie des Sciences*, Vol 171, No 18, pp 1179-1182 Paris, May 1, 1922

The comparison between the wine first drawn off (choice wine), the wine taken off the lees by decantation and the wine taken from the lees by pressing in bags has given respectively in analyses made by the writer: Alcohol % in volume:— 10.55 — 8.50 — 8.95; Total acidity as sulphuric acid 5.50 — 5.40 — 5.45 — Fixed acidity as sulphuric acid 5.10 — 5.0 — 4.90; Volatile acidity as sulphuric acid 0.40 — 0.40 — 0.55 %; Dry extract at 100°: 21.27 — 32.75 — 32.82; Total ash: 2.45 — 2.65 — 2.70; Soluble ash: 2.25 — 1.90 — 1.85; Alkalinity of the ash in bitartrate of potash, per litre: 5.07 — 1.62 — 1.67; Bitartrate of potash: 4.13 — 1.83 — 2.08; Total tartaric acid in bitartrate of potash, per litre: 5.05 — 2.39 — 2.45; Total potash in bitartrate of potash, per litre: 4.59 — 4.14 — 4.17; Sulphate of potassium: 0.31 — 0.34 — 0.35; Phosphoric acid: 0.175 — 0.471 — 0.455; Polarimetric deviation: 0 — 0 — 0; Total alcohol + acid: 16.08 — 13.90 — 14.40; Alcohol Ratio: extract 4.3 — 2.1 — 2.3. These analyses show that there are in the wines of lees compared with the wine drawn off:— 1) a decrease of about 2° in the alcoholic strength — 2) constancy in total acidities, fixed and volatile — 3) increase of dry extract of at least 50 % — 4) slight increase of ash, with decrease of soluble ash and increase of insoluble ash — 5) considerable decrease of alkalinity in the ash, reaching  $\frac{2}{3}$  of the original amount — 6) decrease of 50 % and more of bitartrate of potash and total tartaric acid, while the total potash scarcely decreases by 10% — 7) increase of phosphoric acid, the quantity of which is more than double — 8) very sensible decrease of the total alcohol + acid; increase of the acid ratio: alcohol; decrease of 50 % in the alcohol; extract.

*The bitartrate of potash lost was replaced by biphosphate of potash in pro-*



*portions corresponding to their molecular weights.* — These characters, which are peculiar to wines of lees arise from the digestion process which takes several weeks and are due to old yeasts undergoing decomposition and which have been carried away in quantities with the wine at the time of racking and which are afterwards deposited and constitute the greater part of the lees. The fact that these yeasts are rich in phosphates, lime and magnesia, explains both the peculiar characters of the composition of wines of lees, and the origin of the tartrate of lime in the lees. During the period of rest in small receptacles and before decantation, the proportion of yeasts in process of decomposition is very great with regard to the volume of wine; a molecular exchange is made between alkaline-earth biphosphates which the yeasts diffuse in the wine and the bitartrate of potash which the latter contains. The bitartrate of lime which is formed is deposited and passes entirely into the lees, thus reducing the cream of tartar in the wine; the biphosphate of lime in the lees on the other hand is transformed into very soluble biphosphate of potash which is found again in the wine of lees after decantation or filtration.

The decrease of alcohol is due either to evaporation or to flowers of wine (*Mycoïderma vini*). The increase of dry extract is due to the passing into the wine of nitrogenous substances which the dead cells have diffused in the wine.

**PRACTICAL CONCLUSION.** — It is preferable to pass the muddy lees, left after the first drawing off, immediately through a filter press rather than to leave them for a long time to digest. Wine so extracted by the filter press would have an approximately similar composition to that of normal wine.

F. D.

1098 — **Should Apples for Cider Making be washed?** — GIRARD-VATON, D., in *L'Alimentation moderne et les industries annexes*, new series, Year 19, No. 20, pp. 87-88 PARIS, July 1922.

In Germany, Switzerland and in other countries, it is considered necessary to wash the apples before making cider. In France on the other hand that practice has partisans and opponents. The first remark that generally the apples are covered with dust, mud, dejecta of insects, micro-organisms and refuse of all kinds as well as with a kind of perspiration which they undergo after the fruit is gathered. Even if they look clean, this syrupy perspiration forms a very good stratum for the development of numerous germs. The above-mentioned impurities are mixed with the pulp during crushing; they pass into the must and give the cider a disagreeable taste and smell. On the other hand, the view is held that washing removes the ferments which help fermentation, that it dilutes the must by the water which is added, and lastly that it takes away from the cider, part of the perfume coming from external matter.

The writer has made some researches with the object of determining the quantity and the nature of substances removed by washing. He has subjected several varieties of cider apples to washing, using 20 kg. of each variety. The matter removed by washing varied between 2.05 gm. and

26.85 gm., or the equivalent of 102.5 — 1342 gm per ton, that is to say entirely negligible quantities. The impurities removed formed an unpleasant mud which became even worse after calcination.

Analyses have given on the average the following results:—

Dry extract with "bain-marie" . . . . .	7.258 g
Total sugar . . . . .	4.630 "
Tannin . . . . .	0.023 "
Pectic matter and albuminoid- . . . . .	1.412 "
Ash . . . . .	0.704 "
Total acidity as malic acid . . . . .	0.191 "

For a ton of apples, the loss of sugar which is the most important, would be scarcely 281.5 gm. If washing is prolonged the quantity of matter removed increases; hence, the apples should not remain long in the water and excessive movement should be avoided. After washing it is recommended to dry the fruit. This may be done by means of machinery which should be found in all good cider factories

L. V.

1099 - **The Olive Oil Industry in Greece.** — BOGRIS, D (Inspector of Industry at the Ministry of National Economy), in *L'Economiste d'Athènes*, Year 2, No 27, pp 417-422 Athens, 1922

The annual production of olive oil in Greece amounts on the average to about 73 million *okas* (1 *oka* = 1250 kg), not including that of Macedonia. As the home consumption is from 35 to 40 million *okas* and as New Greece has enough for its requirements and can export olive oil, there remains for export at least 22 million *okas*.

The Greek olive oils are often too acid and sometimes have a disagreeable taste. While in no European State is it permissible to sell as food oil of acidity above 5 degrees (total acidity as oleic acid), the oils retailed in Greece commonly have an acidity of from 15 to 20 degrees, sometimes as much as 30 degrees, in the latter case they are injurious to health.

These drawbacks are due:— 1) to the deterioration of the olives owing to their late collection and bad storing; 2) to the imperfect mechanical plant of the oil factories, 3) to the want of cleanliness in the oil factories.

The writer suggests the adoption of legislative measures to enforce the adoption of scientific methods in the manufacture of the oil as is done in France, and formulates a series of proposals concerning:— bases of valuation of the oils — measures in favour of the consumers — measures against uncleanness in the oil factories — measures for the finest olive oils.

F. D.

1100 - **Manufacture of Tapioca Starch at Porto Rico.** — GORBEA, PLA (Jefe, División de Química), in *Revista de Agricultura de Puerto Rico*, Vol. VIII, No. IV, pp. 39-41. San Juan, June 1922.

The writer suggests that this plant, which is cultivated in all tropical and sub-tropical countries, is capable of great development in the island, especially for the manufacture of its starch which is very much in request for size. A short estimate is given of the cost of a small factory for an output of 120 qx. of starch from 600 qx. of manioc every 24 hours.  
P. C.

1101 - **The Value of Ohio Wheats for Bread-Making.** — CORBOULD, M. K., in *Bulletin of the Ohio Experiment Station*, No. 350, pp. 187-219, with several figs. Worster, Ohio, June 1921.

The spring wheats grown in Ohio belong to the hard variety and are suited to the climate of the Northern part of the State. The winter wheat is subdivided into hard, semi-hard and soft types. The hard winter wheat flour has a high gluten content and is suitable for bread-making, the semi-hard flour is also recommended for the same purpose and cake and pastry-making. The soft winter flours must be blended with a stronger kind, if used for bread-baking, but are very suitable for all other baking-purposes.

The author gives the names of the soft and semi-hard Ohio varieties of wheat which yield the smallest percentage of bran. Soft wheats usually produce a great deal of bran.

A comparison between the wheats grown by the Department of Agronomy at the Ohio Experiment Station has proved that the semi-hard wheats which produce good yields per acre and give general purpose flour are best for Ohio growers.

Musty flour, if free from odour, may be used for bread-making. The flour of sprouted wheat has an improved bread-making quality, if the plumule has not grown longer than the kernel.  
L. V.

1102 - **Manioc Bread.** — GUABRADO, G. A. (Laboratorio de Investigaciones, Sanidad, Habana), in *Sanidad y Beneficiencia* Vol. 27, No. 3-4, pp. 145-146. Havana, March-Apr. 1922

Manioc ("yuca") grows wild in Cuba, where it resists the most severe drought. It supplies the aborigines with bread, and for a quarter of a century has formed the chief food of the rural population of the island.

The starch content could be increased by scientific cultivation. The manioc is not well managed at present; for instance, the extraction of the starch is carried out in a primitive manner and a large amount remains in the pulp, also 450 000 kg. of starch and 225 000 kg. of glucose have to be imported annually into Cuba, whereas it should be possible to export these products on a large scale.

Dr. CALVINO, Director of the "Estación Agronómica Nacional" of Cuba has prepared bread and flat cakes of manioc containing 10%

of wheat flour and has submitted them for examination to the Scientific Laboratory of Sanidad.

Manioc bread, externally, looks very much like that made from wheat, but, on account of lack of gluten, it is not so soft. It is slightly bitter but the taste is pleasant. It crumbles and moistens well during mastication. Like wheaten bread, manioc bread soon becomes stale, but its freshness may be restored by moistening and holding over a fire. The flat cakes are better than those made from wheat.

Regarding its nutritive value, the following Table gives the results of analyses; it should be stated that for the wheaten bread the figures given represent the average of 5 years analyses.

*Analyses of manioc bread and wheaten bread.*

	Manioc bread	Wheaten bread
Moisture . . . . .	26.00 %	29.31 %
Protein (N $\times$ 6.25) . . . . .	11.25	13.45
Starch and reducing sugars . . . . .	49.11	54.42
Fats . . . . .	8.60	1.18
Cellulose . . . . .	4.00	0.63
Ash . . . . .	1.04	1.00
Phosphoric acid in the ash . . . . .	(0.074)	
Acidity calculated as acetic acid. . . . .	0.40	1.40
Calories per Kg. of dry matter calculated according to the metabolic formula . . . . .	4606	4081

If the use of manioc for making bread was extended, better utilisation of the plant would result.

L. V.

1103 — **The Clarification of unfermented Fruit Juices.** — CALDWELL, J. S. (Plant Physiologist Office of Horticultural and Pomological Investigation), in *United States Department of Agriculture, Bulletin No. 1025*, pp 1-30, bibliography of 35 works. Washington, January 23, 1922.

When unfermented fruit juice, such as that of apples or grapes, is prepared by the methods ordinarily employed, a more or less copious precipitate is formed after pasteurisation consisting of cellular debris and substances coagulated by heat. For this reason, a second pasteurisation is effected after an interval, and the formation of a coagulum in the final container is prevented, but the liquid remains permanently turbid and opaque from the presence of considerable quantities of suspended colloidal materials.

In the case of a few heavily pigmented varieties of grapes, the deep colour of the juices masks their turbidity and renders them attractive to the eye. The juices of most white grapes are too opaque to have an inviting appearance, and although their bouquet and flavour are often superior to the pigmented juices, their turbidity counts so heavily against them that no systematic attempts have been made to put them on the market, and they are little used even where pale-coloured grapes abound.

Unfermented apple juice, or "sweet cider", is to a large extent a seasonal product and consumed in considerable quantities in the autumn. Pasteurised unfermented cider has not gained greatly in popularity, the preference being given to synthetic drinks, pasteurised ciders being pronounced "muddy" and unattractive.

In view of the reception given to the clear attractive juices prepared by zealously guarded special methods, it is probable that the consumption of unfermented juices would be largely increased if simple and efficient methods of making brilliant transparent juices of unaltered beverage quality, were generally available.

To discover some such method was the object of the author's researches on apple and grape juice.

It was found that the ordinary filtration does not give satisfactory results when applied to apple, grape and grape-fruit juices, as they are difficult to filter and contain considerable quantities of colloidal material which passes through ordinary filters. Clarification by means of proteolytic enzymes is possible, but requires too much technical skill and supervision.

The addition of tannin and gelatine, casein, fish glue, egg-albumen and blood is unsatisfactory, for precipitation is slow and incomplete, the chemical composition of the juices is altered, and their palatability and flavour are affected. The preparation of a suitable silicic-acid gel is tedious and difficult and the precipitation obtained by its use is imperfect and slow owing to the clogging of the filters. Of the inert adsorbing agents, carbon is not suited for apple and grape juices as it removes flavouring substances, is a decolourising agent, and does not entirely remove pectins and gums, also, fine particles of carbon which pass through the ordinary filters remain in suspension and are finally deposited on the sides of the container. Diatomaceous earth is by far the most satisfactory aid to the filtration of fruit juices yet employed, for it removes the colloidal materials and leaves intact the colouring and flavouring substances. As obtained in the markets, diatomaceous earth contains varying amounts of wax derivatives which impart perceptible foreign flavours to most juices, but these objectionable materials are readily removed by heating the earth to redness for a short time. Earth that has been used may be "revivified" for future use by similar treatment.

The juice to be clarified should be allowed to stand undisturbed for 12 to 18 hours in order to permit the cellular debris to settle, and should then be siphoned, or decanted, from the sediment. The best results are obtained when the juice is thoroughly mixed with the diatomaceous earth at the rate of 6 to 8 pounds per 100 gallons and immediately filtered. During filtration, the juice on the filter must be well agitated at intervals to keep the earth in suspension and prevent obstruction of the filter.

The author describes the construction and operation of some simple but effective filters. For semicommercial operations he advocates a filter composed of a thick paste of diatomaceous earth supported by a nickel wire screen and a cloth; filtration is assisted by a suction pump. For household use, satisfactory results are obtained by gravity filtration

through a disk of earth somewhat thicker than the one described above. The vessel used should be at least 60 m. high and must be kept almost constantly full. Heating the juice before filtration has many advantages. If the heating is effected in open vessels or tanks, the temperature of the juice should not be allowed to exceed 130° or 140° F (44.5 — 60° C) nor should it remain long at this temperature in the case of apple juice or delicate grape juices as deterioration in flavour is easily produced. A few varieties of grape yield juices may be heated to 170° F (71° C) without injury.

By means of the above described process, preliminary pasteurisation and storage are eliminated; this shortens the process of preparation, decreases the losses, and improves the appearance of the product. Juices thus treated remain perfectly clear and transparent when bottled and pasteurised, and retain the characteristic flavour and quality of fresh juices.

L. V.

1104 — **Analyses of Italian preserved Fruits.** — ZAY, C (R. Stazione chimico agraria di Torino), in *La Stazione sperimentale agraria italiana*, Vol. LV, No. 16, pp. 129-135. Modena, 1922.

The writer, being unable to find any analyses of Italian fruit preserve in the literature of agricultural chemistry, has analysed a series of preserves, jams and jellies of various fruits prepared by several Piedmont Firms.

The results (detailed in a tabular statement) show that the products of Italian industry do not differ essentially from those prepared in foreign countries, to which also they are in no way inferior.

F. D.

**INDUSTRIES  
RELATING  
TO ANIMAL  
PRODUCTS**

1105 — **Studies on the Biology of Lactic Acid Bacteria.** — GORINI, C (Laboratorio Bacteriologico della R. Scuola Superiore di Agricoltura, Milano), in *Journal of Bacteriology*, Vol. VII, No. 2, pp. 271-276. Baltimore, March 1922.

The author gives a short account of the studies he has made of recent years on the bacteria producing lactic acid, these micro-organisms include the lactococci and the lactobacilli.

**LACTO-PROTEOLYTIC PROPERTY** — Many of these bacteria first coagulate and afterwards dissolve casein. Their action is checked by the addition of calcium or other substances, and depends upon certain factors of which one of the most important is *temperature*. As early as 1897, the author noticed that high temperatures promote the fermentation of lactose, whereas low temperatures are favourable to the proteolysis of casein.

He subsequently studied these processes more in detail. It appears that many bacteria when cultivated at 25°-35° C, show no lactic-proteolytic property, though this appears at 15°-20° C, i.e., the temperature maintained during the ripening of cheese. The composition of the medium is a matter of great importance. Thus even in 1902 the author observed that some bacteria dissolve casein but not gelatine, while others break up gelatine and leave casein intact, and certain species have a proteolytic action on both. The author also emphasises the injurious effect exerted upon proteolysis by the products of the process itself; these

are found in ordinary milk as a result of the great increase in the microorganisms before sterilisation. The *sterilisation method* is another important factor. If milk is sterilised at a high temperature, till it becomes brownish in colour, it can no longer be used for the demonstration of proteolytic properties; this explains the negative or almost negative results obtained by certain investigators.

**BACTERIAL FLORA OF THE MILK DUCTS.** — It has been shown that microorganisms are found on the udder, in spite of external cleanliness and healthy condition of the cow. This bacterial flora may be either useful or injurious both from the hygienic and dairy-industry standpoints. For this reason, the author made a selection of milch cows by the composition of their mammary flora and judged the quality of the milk yield according to the results of the fermentation tests.

**HEAT RESISTANCE.** — The author has proved that the non-sporiferous lactic acid bacteria resist temperatures of over 100° C owing to the formation of a protective layer of casein.

**SPORE-FORMING BACTERIA.** — The author isolated a *Bacillus acidificans-presamigenes-casei* present in cheese and also found a similar form in silage; and considers that spore-forming lactic-acid producing and lacto-proteolytic bacteria are very wide-spread.

**VISCOSITY.** — The power of lactic acid bacteria to render milk viscous before making it acid has been observed by several investigators. The author recognises that this is a constant property of many bacteria which has passed unnoticed because it is transitory during the fermentation process.

**APPLICATION TO THE CHEESE-MAKING INDUSTRY AND TO ENSILAGE.** — Selected lactic acid bacteria assist the ripening of cheese by 1) eliminating the putrefaction and gas-forming bacteria; 2) accelerating the maturation process. The same may be said as regards their effect upon ensilage. Lactic acid bacteria give very good results, especially if an impermeable bed is used, when the forage is half-dry, provided the air is excluded by so heaping up the silage, that the internal temperature rises to 35°-40° C. Inoculation gives excellent results particularly when the silage is not of a kind to set up spontaneous lactic acid fermentation.

Many of the author's results have recently been confirmed by other workers including BARTHEL, BOCKHOUT, DE VRIES, BURRI, ESTEN, EVANS, HARDINGS, HARRISON, HOFFMANN, LÖHNIS, ORLA JENSEN etc.  
L. V.

1106 - **Commercial Production of Butter in the United States.** — See No. 1096 of this Review.

COMMERCE OF  
PRODUCTS ..

# PLANT DISEASES

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS

**GENERAL** 1107 - Correlation between the Aluminium Content of Sugar Beet and Bacterial Infection. — See No 1031 of this Review

**RESISTANT CROPS** 1108 - Various Plants introduced into the United States resistant to certain Diseases and Pests. — See No 1031 of this Review

**PARASITIC DISEASES OF VARIOUS CROPS** 1109 - The Ascomycete *Ophiobolus cariceti*, as the Cause of Take-all of Cereals and Grasses. — 111/PATRICK H M THOMAS H I and KIRBY R S in *Mycologia*, Vol XIV, No 1, pp 303 figs 1 pl 1 Lancaster, Pa 1922

In July 1920, penithecias of a species of *Ophiobolus* were observed at East Rochester (New York) on wheat plants showing characteristic symptoms of the take all disease, subsequently reported in various localities in the State and also elsewhere (1)

The fungus has been obtained in pure culture and repeated inoculations have shown it to be a specific agent of this disease

This fungus, after comparative experiments made with material from America, England, Italy, France, Japan and Australia, has been classified as *O. cariceti* (Berk and Br) Sacc

A complete diagnosis of the parasite is given G T

1110 - Observations made in New York State on the Take-all Disease of Cereals and Grasses (*Ophiobolus cariceti*) (L). — KIRBY R S in *Phytopathology*, Vol XII, No 2 pp 66-68 figs 3 pl 3 bibliography of 31 works Lancaster, Pa 1922

A survey made in 1921 in New York State demonstrated that the 'take all' disease caused by *Ophiobolus cariceti* (Berk and Br) Sacc was present in nearly one half of the winter wheat fields of 16 countries in the west of the State. The disease was as severe as that described in Australia and Europe. The average damage in the 78 fields found infected in 1921 was about 2%, and the maximum damage in any one field was about 20%.

The most typical symptom of the disease is a dwarfing of the host plant, which includes a reduction in height, in the number of tillers, in the number of heads, and in the size and amount of grain produced. The yield of an infected plant was on an average about 1% that of a healthy plant

(1) See *R Jm* 1921, No 104 (Fd)

(2) See No 1109 of this Review (Ld)



The fungus is confined to the roots and lower internodes of the host, where a pronounced discolouration occurs. A typical plate of mycelium is found between the leaf sheath and the culm, and perithecia are produced in abundance, more than 100 having been found on single culms of wheat and *Agropyron repens*. As a result of inoculations under glass, typical perithecia were produced on wheat, barley, rye and one or more species of the following wild Gramineae:— *Agropyron*, *Bromus*, *Ulymus*, *Festuca*, *Hordcum*, *Hystrix*, *Lolium* and *Phalaris*.

None of the 54 varieties of wheat tested in the greenhouse, showed any marked degree of resistance to take-all. These varieties included specimens of the following species: *Triticum sativum*, *T. compactum*, *T. turgidum*, *T. durum*, *T. dicoccum*, *T. Spelta*, *T. polonicum* and *T. monococcum*.

The causal organism was isolated and grown in pure culture on numerous media. Typical perithecia have been produced in pure cultures. In the present investigation seeds from infested plants did not act as carriers of disease. Soil from infected spots in the fields acted as a distributing agent for several months, but at the end of 8 months, soil which had been kept in the laboratory did not act as a carrier. Pieces of infected straw containing perithecia were very effective carrying agents; the virulence of the organism had not decreased at the end of 8 months.

*G. cariceti* requires a condition of alkalinity for optimum growth. This explains why the addition of alkaline substances to the soil has been observed to favour the spread of disease whilst the addition of acid-forming substances has the contrary effect.

The most promising methods of control seem to be: the practice of four to five year rotations; the eradication of wild gramineae and cross-fertilised cereals, which may act as hosts; discontinuation of the practice of digging in wheat stubble for 3 years preceding the sowing of wheat; cleaning the wheat seed thoroughly to remove all bits of straw which might carry perithecia; the discontinuance of the practice of liming the soil before sowing. Other suggested methods of control are late sowing and the use of resistant varieties, although definite results have not been obtained in either case.

G. T.

1111 - Moroccan Durum Wheats liable to Rust. — See No. 1046 of this Review

1112 - Diseases and Pests of the Olive Tree, in the United States. — See No. 1058 of this Review.

1113 - Diseases and Pests of the Cacao in Bahia, Brazil. — See page 1160 of this Review.

1114 - Leaf-Spot Disease of Tobacco caused by *Phyllosticta Nicotiana* in North Carolina. — WOLF, F. A., in *Phytopathology*, Vol. XII, No. 2, pp. 99-101. Lancaster, Pa., 1922.

For several years in succession, a leaf spot disease of tobacco has been noted in North Carolina, both upon seedlings in the nursery, and upon more mature plants in the field. Brownish spots are formed irregular

in outline, varying in size from 1 to 10 mm., lightest in colour near the centre, and bordered with pale or yellowish-green. Pycnidia of a *Phyllosticta* (identified provisionally by the author as *Phyll. Nicotiana* E. and E.) are seen in the dead tissue.

The fungus has been isolated and grown in pure cultures and successful inoculations of seedling tobacco plants under glass have been made.  
G. T.

1115 - *Soja max*, *Dahlia rosea* and *Cosmos bipinnatus*, new Hosts of *Bacterium Solanacearum*, in North Carolina. — WOLF, F. A., in *Phytopathology*, Vol XII, No 2, pp 98-99. Lancaster, Pa, 1922

In August 1921, specimens of *Soja max* sent from Columbus (N. Carolina), of *Dahlia rosea*, and of *Cosmos bipinnatus*, collected in Raleigh, were attacked by wilting, less marked in the case of the soybean, probably owing to the woody nature of the stems and petioles.

Upon microscopic examination of the xylem tissues, bacteria were observed; these were isolated from each host, and eventually identified as *Bacterium Solanacearum*, and according to the author the diseased condition of the three plants may be attributed to this bacterium

G. T.

1116 - *Bacterium Solanacearum* injurious to various cultivated Plants in the Philippines (1). — WELLES, C. G., and ROLDAN, E. F., in *The Philippine Agriculturist* Vol X, No 8, pp 393-398 3 pl Los Baños, Laguna, 1922

The disease produced by *Bacterium Solanacearum* E. F. S. is one of the most serious of the maladies which attack the tobacco plant in the Philippines. It is common in all the tobacco-producing regions, and causes an annual loss of between 5 and 15 % of the crop; on seriously affected soil, 50 % of the crop may be destroyed. Although seedlings in the nursery are attacked as well as adult specimens, the plants that have been lately set out suffer most

The disease also attacks the tomato and egg-plant on a large scale according to observations made near Manila and in the Province of Laguna. In the fields of the Los Baños College of Agriculture, 70 to 100 % of the tomatoes, egg-plants and tango plants (*Chrysanthemum coronarium*) were found to be suffering from the malady. Nearly all the tomato plants were killed while still young, the egg-plants arrived at the fructification stage, but none of the fruits ripened. *Chrvs. coronarium*, like *Ricinus communis*, was attacked at all stages of development.

The disease is characterised by the more or less rapid and complete withering of the organs of the plant which unless it has reached an advanced stage, usually succumbs. Old plants although they wilt and wither manage to survive.

Numerous unsuccessful attempts to control this disease have been made at Los Baños. GARNER, WOLFF and MOSS state that the only

(1) See also R Aug. 1922, No 875. (Ed)

remedy is a five-year rotation during which all the host plants of *Bact. Solanacearum* are rigidly excluded from the infected soil.

It has been found that the egg-plant suffers little from the disease if sown in the rainy season so as to ripen in December. G. T

1117 - *Fusarium* sp., a Deuteromycete injurious to the Tomato Plant in North Queensland. — POLLOCK, N A R, in *The Queensland Agricultural Journal*, Vol XVIII, Part. 1, pp 10-12 Brisbane, July 1922.

Some five or six years ago, a disease due to a species of *Fusarium* was noticed for the first time in the Bowen district where the tomato is cropped annually over considerable areas. In this district, the disease is of general occurrence and few areas even on virgin soil are free from the infection.

The disease has also been observed at Townsville and Cooktown, but it does not seem to exist in other areas where tomatoes are grown for market such as Guthalungra, Gumlu, Cloncurry, Charterstown, Cape-River etc.

The fungus attacks the roots and spreads through the fibro-vascular tissue which when cut in sections is seen to be brownish. The first indication of attack is usually the yellowing of one or more of the bottom leaves followed by the wilting of one or several branches. Where the plant has no tap-root, one branch is usually first affected followed later by others, until ultimately the whole plant dies. The period from the first sign of attack to the death of the host, varies according to its power of resistance and the severity of the infection, so that the plant may die at once or linger on for several weeks.

It is possible that the disease may extend to the fruit, but no external or internal signs of its presence have hitherto been detected.

The disease sometimes shows itself a few weeks after the plants have been set out, it is usually not found in those left in the seed-bed even if they have been neglected.

Self-sown plants appearing in fields where tomatoes were grown the previous season frequently show no signs of infection. One case of the serious infection of self-sown plants has been observed, but the land was sown with another crop, and probably some damage was done to the tomato-roots during cultivation.

While so far no variety of tomato has proved immune, some varieties are more resistant than others. Early maturing varieties such as 'Chalk's Early Jewel' appear more subject to the disease than the main crop varieties.

No data are available as to the length of time the fungus may retain its vitality in the soil in the absence of any plant host, but there is abundant evidence that the infection increases when tomatoes are grown in succession upon the same ground.

It has been noted that the fungus spores were probably carried by the seed in the first instance, but when diseased and healthy plants are set out together, the disease can be contracted through the soil.

It is clear that the fields on which diseased plants have grown can carry infection, and that it may be transmitted to other fields by implements or other mechanical means.

The disease may also make its appearance on the roots, but the author is of opinion that the fungus generally enters by means of lesions due to want of care in lifting young plants in the nursery, or inflicted by different tools etc.

An experiment was carried out in this connection; when setting out the plants their roots and stems, as far as the bottom leaves, were dipped in a solution of 1 part copper sulphate to 500 parts by weight of water with a view to sterilising the broken rootlets, at the same time they were watered with a similar or weaker solution. Although complete immunity was not gained, the treated plants were longer in developing the disease than the untreated.

The author believes that crop rotation is the chief factor in the control of this disease. Sweetening of the soil by liming, and increasing the amount of plant food by the application of fertilisers to insure vigorous growth are necessary processes. In addition to the foregoing and equally important are the raising of disease-resistant strains and careful attention to seed selection

G. T

1118 - *Cercospora Melongena*, n. sp. of Hyphomycete injurious to Egg Plant in the Philippines. - WELLES, C. G., in *Phytopathology*, Vol. XII, No 2, pp 61-65 figs 2 Lancaster, Pa., Feb 1922

A spotting of the leaves of the egg plant has been observed recently in Los Baños, Laguna Province (Philippine Islands), especially on the lowest and oldest leaves. Chlorotic irregular shaped spots, frequently fusing, appear first on the upper surface of the leaf, later reaching the under surface. With age, the central portions of the lesions, which may cover an area of 6 to 8 mm. dry up and turn greyish-brown and show concentric rings. In advanced stages of spotting, the dead tissues fall out leaving a shot-hole effect.

According to the author the agent responsible for this disease is a new species of *Cercospora* which he describes and names *C. Melongenae*.

The native variety of egg plant has a long black fruit, turning yellow when ripe, and this has been seriously damaged by this disease, while the Siamese variety, small round and yellow fruit, is but slightly affected. All the plants in the district where the disease was first notified were infected, with from 50 to 100 % of the leaves attacked.

Several experiments have shown that spraying with Bordeaux mixture every two weeks is sufficient to hold the disease in check. However, comparison between sprayed and unsprayed plants has shown no important difference as regards setting or development of fruits. On the other hand, spraying tends to increase longevity of leaves and the general vitality of the plants. From these results it seems that spraying is not justified from the commercial standpoint for mature plants, unless the disease threatens to be unusually severe resulting in serious defoliation. Should

this occur, especially with young leaves or seedlings, spraying may be relied upon as a control measure. G. T.

1119 - **Banana Freckle (*Phoma Musae*) in the Philippines.** — LEE, H. A., in *Phytopathology*, Vol. XII, No. 2, pp. 101-102, figs 1 Lancaster, Pa., 1922

On both green and ripe bananas in the public markets in the Philippines, sometimes dark reddish-brown and sometimes black, minute distinct and hard spots were noticed. Usually they occur in large numbers and in some cases in masses on the fruits. Similar spots are seen on the leaves, but rather more streaked.

The varieties known locally as Latundan, Borongan, Lacatan and Saban of *Musa Sabientum* are affected.

Examination of the spots shows the presence of pycnidia and spores which resemble very closely those of *Phoma Musae* Carpenter, previously reported in the Hawaiian Islands as the cause of the "banana freckle"

The disease is much more abundant at the close of the wet season than during the dry season. As bananas in the Philippines are grown entirely for local consumption, the disease here does not cause the loss which occurs in the banana industry in Hawaii

It has recently been reported that this disease is widespread in the Sulu Archipelago, and in the Island of Mindanao in the Philippines. These islands are sparsely populated, and no bananas have been imported from the western hemisphere which indicates that the banana freckle is indigenous or at least has existed a long time here.

There is a continual migration of labour from the Philippines to the sugar plantations of Hawaii, and it may be supposed that a few infected fruits have been introduced in this way into the banana plantations of Kalili Valley, adjoining Honolulu, where the disease was first reported for Hawaii. G. T.

1120 - ***Penicillium expansum*, Stem End Rot of Apples, in California.**

BARNUM, C. C. in *Science*, new series, Vol. LV, No. 1435, pp. 707-708 Utica, N. Y., June 30, 1922.

During the late spring of 1921 a large number of apples which came from a lot removed from a cold storage temperature of 32° F and kept for a few days at 45° F, started to decay at and around the base of the stems. When placed in a moist chamber, these apples very soon decayed without wrinkling, becoming soft and watery. Decay was of a sharply defined nature and the affected parts could be easily removed. Normally these decayed apples were soon covered with green mould. On examination of the stems of apples in storage it was found that many were green as the result of fungus conidia, which after cultivation were identified as *Penicillium expansum* Lk.

No mention is made in the literature of the subject as to the entrance of a decay-producing organism through the stem. The decay of apples, which is ordinarily caused by *P. expansum*, is invariably mentioned in connection with abrasions of the skin, such as insect punctures and wounds or injuries of a mechanical nature. Some authors refer to infection as

entering through the calyx, but no-one has ever notified stem end infection.

During the autumn of 1921, large mature Yellow Bellefleur apples were collected from trees in a Berkeley garden. These were picked with the fruit spurs attached, carefully washed in alcohol, mercuric chloride solution 1-1000 and distilled water, consecutively. The leaves were clipped from the spurs to facilitate the process, but the spurs were not removed. Moist chambers were sterilised and prepared, the spurs were then removed from each apple and conidia of *P. expansum* were applied to the freshly exposed surface at the ends of the fruit stems, and the apples were then placed in the moist chambers. Control fruits similarly treated, but not inoculated, were kept under the same conditions in the laboratory. Of the six apples thus treated four developed the characteristic stem rot and were soon completely decayed. The control apples remained in good condition for 3 months.

Yellow Newtown apples were picked in the same manner at Watsonville (California), and brought to Berkeley. On October 17, 1921, three of the ripest of these apples were treated and inoculated in the same way as the Yellow Bellefleur specimens. On November 18, the form of decay of all three apples was identical with that observed on fruits naturally infected. Six Yellow Newtown apples were treated in the same manner and inoculated with the same organism several days later than the previous group, and they all showed signs of the typical decay. In every case the controls remained in good condition. After six weeks all the apples inoculated were entirely decayed and covered with green conidia. Cultures of these Conidia appeared identical in every way with the original culture. Further inoculations were made with re-isolated cultures on carefully sterilised apples. At the same time other apples were inoculated with the original culture. Results were identical, the typical *Penicillium* decay showing itself at every puncture. A *Penicillium* isolated during the autumn of 1921 from decaying plums was found to give rise to typical decay in apples after inoculation. This plum *Penicillium*, inoculated into the stems of three Yellow Newtown apples caused typical stem end decay after three weeks. The same *Penicillium* was found later to be identical with the original *Penicillium* isolated from apples.

Preparations were made from the infected leaves on some of the apples used in the experiments and typical colonies of *P. expansum* were developed. About 15 % of the colonies were identified as belonging to the *Penicillium* species; a considerable number were responsible for typical *P. expansum* decay when inoculated into ripe apples. This fact would seem to indicate the abundance of the fungi in the trees at harvest time.

These results prove that stem end infection of apples is possible. Observations made by the author indicate that this mode of infection is quite common among apples in California, especially on Yellow Newtowns. Although checked by cold storage, the rot makes some progress at a temperature of 45° F and at room temperature decay is rapid.

G. T.

1121 - Observations on the Erysipheae *Microsphaera quercina*, *Sphaerotheca mors-uvae* and *Oidium farinosum*, in Italy. — TROTTER, A., in *Annali della R. Scuola superiore d'Agricoltura in Portici*, Vol. XVII, pp. 3-11 (extract). Portici, 1922.

*Microsphaera quercina* (Schw.) Burr. — On the upper surface of oak leaves collected between the 20th and 30th of November 1920 at Zaffaria Province of Messina (Sicily), which were covered with the characteristic "oidium", the writer noticed some perithecia of *Micr. quercina*, previously found in Italy, in the Province of Bologna (1) and at Rome (2).

*Sphaerotheca mors-uvae* (Schw.) Berk. and Curt. — This Erysipheae reported as found for the first time in Italy in 1914 (3), had, however, been previously observed in August 1904, at Tornetti di Viù, in the Province of Turin. From 1912, the writer had found it in the Province of Avellino (Celsi, Forino and Avellino), where it may have been introduced by means of infected plants of *Kibes* coming from Northern Italy. At the present time the presence of the fungus is certain in Piedmont (Province of Alessandria (4), Novara (4) and Turin), in Lombardy (Milan and Pavia) (5), in Venetia and in Campania (Prov. of Avellino).

*Oidium farinosum* Cooke. — On apple trees grown in the nurseries of the Royal School of Oenology and Viticulture at Avellino, an extensive attack of *Oidium farinosum* has been observed for several years, taking place in spring. The fungus had been only recently reported in Italy, and especially in Northern Italy, whence it may have reached Avellino on young wild apple plants. This conidial form — which, according to the writer, should be attributed, in the present case, to *Podosphaera leucotricha* (Ell. and Ev.) Salm — shows a great tendency to propagate itself, especially on young nursery plants, the buds of which are attacked to such a degree that they die and dry up in a very short time. According to the writer, wild plants, obtained from seed and not yet grafted, were all more or less badly attacked, while the grafted plants had vigorous grafts, with buds almost entirely unharmed. G. T.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

1122 - Observations on the Coccidae of Egypt. — HALL W. J., in *Ministry of Agriculture, Egypt, Technical and Scientific Series, Bulletin No. 22*, pp. 1-51, pl. 3. Cairo, 1922.

GENERAL

A record of the fifty-six species of Coccidae of Egypt to be found in the collections of the Ministry of Agriculture. It is probable that over a hundred identified species exist in the country, and doubtless some new to science will be collected, when it is found possible to make a detailed examination of the desert flora as a whole.

A brief description is given of the external characters of the species

(1) See R. Feb. 1920, No. 264 (Ed.)

(2) See R. May 1921, No. 508 (Ed.)

(3) See R. Dec. 1914, No. 1188. (Ed.)

(4) See R. July 1922, No. 785. (Ed.)

(5) See R. Dec. 1914, No. 1188 (Ed.)

enumerated with references to any peculiarities. The microscopic characters are only mentioned when the preparations made by the author show any distinct divergence from type. Information is added as to bibliographical sources in which will be found descriptions and illustrations of the various species. A complete list of the host plants is also given, and in the case of species which have proved recognised pests, certain observations are made as regards the outbreak and the control measures adopted, including the legislative orders.

In the appendix, a short list of the Coccidae collected in Palestine at the end of 1921, is given

G. T.

INSECTS, ETC  
INJURIOUS  
TO  
VARIOUS  
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1123 - *Vespa germanica* and *V. vulgaris*, Hymenoptera injurious to the Ghesab (*Pennisetum spicatum*) in Sicily. - See No. 1036 of this *Review*

1124 - *Calligrapha exclamatoris* and *Mordellistina pustulata*, Beetles, Injurious to *Helianthus* spp. in Manitoba, Canada. - CRIDDLE, N., in *The Canadian Entomologist*, Vol. LIV, No. 5, pp. 97-99. Orillia, May 1922

The recent cultivation of sunflowers (*Helianthus* spp.) for fodder purposes has provided a new instance of hitherto harmless insects becoming pests

In Canada a large number of wild species of sunflower are found some of which are closely allied to the cultivated kinds and as the wild varieties have their insect enemies there is no reason why these should not spread to those under cultivation and thus become of economic importance

The sunflower-leaf beetle (*Calligrapha exclamatoris*), is a very common and widespread insect in Manitoba where it is found feeding upon the leaves of various species of wild sunflower. It seems to live exclusively on *Helianthus*, and for that reason, promises to be one of the most important insects attacking this plant. The beetle has already spread to cultivated sunflowers on which it breeds as rapidly as upon the wild kinds. The author gives a morphological and biological description of the different stages of the insect, both beetle and larvae feed upon the leaves of sunflowers. In nature, they are most frequently met with on perennial species such as *Helianthus giganteus*, though they have been noted in numbers upon *H. annua petiolaris* also, and from this have spread to cultivated species

There is but one generation of the insect in Manitoba. The adult form superficially resembles the Colorado potato beetle (*Leptinotarsa decemlineata*), but is considerably smaller. Sprays similar to those used for the latter pest are also effective against the Sunflower beetle.

The larvae of another beetle, *Mordellistina pustulata*, were first collected from the stems of the Red-root Pigweed (*Amaranthus retroflexus*) which had prematurely died. Later, they were found hibernating in sunflower stems some of which they had riddled with their tunnels. These larvae confine themselves largely to the pith, but also injure the more woody parts; they occur most frequently near the base of the plant, al-



though any portion of the stem may be infested. Plants thus injured have a stunted appearance and sometimes die. Several larvae may infest a single stem and these remain within the plant until the following spring when they pupate, the adult beetles make their appearance in June. A description is given of the morphological characters of the larva and of the adult beetle.

In addition to the beetles mentioned above, a weevil, *Desmoris constructus*, has been found feeding on the flowers of *Helianthus*, but it remains to be seen whether it will become of economic importance. G T

1125 - *Pyrausta penitalis* -- a Microlepidopteron parasitic on the Nymphaeaceae, *Nelumbo lutea* and *N. nucifera* in the United States. — AINSLIE, G. G. and CARTWRIGHT W. B. in *United States Department of Agriculture, Bulletin* No. 1076, 14 pp. pl., 1. Washington D. C., July 1922.

*Pyrausta ainsliei* Heinrich (1) and *Pyr. penitalis* Grote are two closely related species very similar in many morphological and biological characters to the maize borer (*Pyr. nubilalis* Hübner) (2) recently introduced into America from Europe. It therefore seemed possible that a close study of the life-history and habits of the two native species might bring to light some facts that would help to determine the potentialities of the new pest.

In order to make the habits of the American species better known a paper dealing with *P. ainsliei* from the biological standpoint, has already been published, the present paper treats of the life-history, habits and enemies of *Pyr. penitalis*.

The authors' work dates from July 1919, and was carried out at Kimberlin Heights and Knoxville in Tennessee where the Microlepidopteron was chiefly studied on the yellow lotus (*Nelumbo lutea*), this Nymphaeacea and *N. nucifera* are as far as is known at present, the only natural hosts of the insect.

The larvae feed on the leaves of *N. lutea* which is grown as an ornamental plant and not only destroy them, but also attack and deform the pods, thus spoiling many of the seeds.

In confinement in the laboratory the partly grown larvae found on lotus fed readily and completed their development on smartweed (*Polygonum pennsylvanicum*), buckwheat (*P. lagopyrum*) and dock (*Rumex crispus*). G T

1126 - The Banana Weevil (*Cosmopolites sordidus*), injurious also to Abaca (*Musa textilis*), in the Philippines. — CENDANA, S. M. in *The Philippine Agriculturist*, Vol. X, No. 8, pp. 367-370, pl. 5, 108. Batavia, Laguna, 1922.

Although reported first in the Philippines only twenty to thirty years ago, *Cosmopolites sordidus* Germ. judging from its wide distribution, was certainly in existence before that time, and has been the cause of serious losses both of banana and abaca plants (*Musa textilis*). In 1916 this coleopteron killed large numbers of banana and abaca plants in Pacts, La-

(1) See R. July 1921, No. 783. (Ed.)

(2) See R. May 1921, No. 585. (Ed.)

guna Province. To-day the Pacte abaca industry is practically ruined.

The insect is a serious pest throughout the Philippines, and attacks banana plants of all varieties and at all stages of development. Most of the injury is done to suckers of the size best suited for transplanting, that is, from 75 cm. to 1.5 m. high.

The first outward indication that a sucker has been attacked is its loss of vigour. As the attack continues the unopened leaves die and fall off. If the sucker is removed and sliced through, the bulb is found to be riddled with holes, tunneled out by the weevil. The older suckers are not killed as a result of attack, but are so weakened that the flowers produced are abnormally small. Observations made at the College of Agriculture, Los Baños, indicate that the small and medium sized varieties of banana are more liable to attack than the larger varieties. Further experimentation is however, necessary. The abaca appears on the other hand to be less readily attacked than the banana; here again further experiments are needed.

Detailed information is given as regards the habits and life history of the insect

The insect is undoubtedly distributed by the transportation of infested suckers and root stocks for propagating purposes. The beetle rarely flies, but is able to crawl along the ground and can cover at least 15 metres each night.

No natural enemies of *C. sordidus* have been discovered in the Philippines, where amongst other control measures tried, infested suckers have been soaked for varying lengths of time in water and in formaldehyde solutions of different strengths. It was found that formaldehyde has a negligible effect on the vitality of the insect. In water the larvae and pupae from both bananas and abacas died within 72 hours, and only in a few cases were the larvae found dead after 48 hours. The adults however appeared to survive and usually crept to the part of the suckers above water, and can thus in most cases be readily collected and killed.

The stools cut during the harvest should not be left in the fields as they would harbour the beetles and act as a breeding ground.

Plantations should as far as possible be kept in good condition and very old plantations should be cut down and the land ploughed. Crop rotation is also advised.

G. T.

1127 - *Tetranychus yotheresi*, a Mite Injurious to the Avocado and other Plants in Florida. — MOZNETTE, G. F., in *United States Department of Agriculture, Bulletin No. 1035*, 15 pp., figs 11, 1 coloured plate Washington, D. C., 1922.

The red spider, *Tetranychus yotheresi* Mc.G., was recognised as a formidable enemy of the avocado (*Persea gratissima*) in Florida as early as 1909, since which time the damage caused by it has increased each year.

In groves where the red spider abounds, the trees frequently become defoliated prematurely during the winter season. This generally results in an abnormal development of bloom the following spring, and the weakened trees are unable to set and hold a full crop of fruit.

The red spider punctures the leaves and sucks the contents forming white spots at the point of attack ; later, the leaf becomes red and appears scorched. The foliage so attacked soon falls.

*T. yothersi*, which was first named and described from specimens on the leaves of camphor (*Cinnamomum Camphora*) sent from Florida, has been found by the author on both the West Indian and Guatamalan varieties, of *P. gratissima*. It occasionally causes considerable injury to the mango (*Mangifera indica*), Camphor (*C. Camphora*) and the Australian silk oak (*Grevillea robusta*) in Florida. It has also been collected there on *Eucalyptus* sp., *Terminalia Arjuna*, *Anona squamosa*, *Cucumis sativus* and *Icacorea paniculata*.

In S. Carolina, the pest has been found on *Ulmus* spp *Salix* sp., *Quercus alba*, and *Hicoria Pecan* ; and in N. Carolina on *Ulmus* sp.

A description is given of the life-cycle, habits and biology of the mite.

The following predatory enemies attack *T. yothersi*; *Scholothrips sex-maculatus* Pergande, *Chrysopa lateralis* Guer., *Scymnus utilis* Horn, *Sc. kinzeli* Casey, and *Leptothrips mali* Hinds : of these *Sc. utilis* is the most formidable.

Several insecticides have been successfully used against the avocardo red spider. finely powdered sulphur, lime-sulphur spray, commercial sodium sulphide, and nicotine sulphate containing 40 % nicotine.

Dusting with powdered sulphur is by far the quickest method and would be very practical, but for the fact that the presence of other insect pests in addition to red spider necessitates the use of liquid insecticides.

During the winter, after the fruit has been gathered it is advisable to apply a lime-sulphur solution in the proportion of 1 gallon of concentrated solution to 60 gallons of water. When the temperature is above normal, or when the trees do not attain a thoroughly dormant condition, 1 gallon of the concentrate to 75 gallons of water can be used.

Sometimes the mites make their appearance in the autumn before the fruit is picked. At this season, a 40 % nicotine sulphate spray (in the proportion of 1 part to 900 parts of water) with the addition of 2 or 3 pounds of fish-oil soap to each 100 gallons of the diluted spray, is temporarily effective and does not spoil the fruit.

The spray rod and spray gun have both been used in these operations, but it was found that the latter gave more satisfactory results.

Orchards mulched in various ways are generally less infested with red spider in South Florida than those where clean culture is practised. The avocardo, however, seems to thrive best where mulching is carried out and the moisture is conserved.

One factor largely influencing the appearance and abundance of red spider in a grove is the vitality of the trees. Nothing is to be gained by allowing trees to suffer from want of proper attention such as mulching, fertilisers and culture.

G. T.

[1187]

1128 - The Beetle, *Ips Pini* as a primary Pest of *Pinus divaricata* and *P. resinosa* in Minnesota. — GRAHAM, S. A., in *The Canadian Entomologist*, Vol. LIV, No. 5, pp. 99-100 Orillia, May 1922

Although it has been generally established that *Ips pini* Say is normally a secondary parasite, and usually attacks only dead or dying trees, this beetle has also been known to kill healthy trees as actually occurred in Itasca Park during the summer of 1921. The specimens destroyed were ten in number, 7 being young, rapidly growing Jack pines (*Pinus divaricata*), varying from 2 ½ to 5 inches in diameter on the stump and 3 healthy Norway saplings (*P. resinosa*) about 15 years old.

Each of these trees was very heavily infested from the surface of the ground almost to the top by the first brood beetles, and must have been attacked simultaneously by a large swarm of the insects. Apparently the attack was concentrated upon the few trees killed, since a careful examination of surrounding pines failed to show any signs that other individuals had been infected. Probably the beetles were attracted by the presence of two freshly felled pines which had been seriously infested. So large a number of the insects were present that many were forced to find quarters in the standing trees near.

It is a curious fact that the beetles did not infest the large piles of recently-sawn pine-logs of which there were many in the neighbourhood. The small group of heavily infested trees were quickly discovered by woodpeckers which destroyed at least 90 % of the insects, both adult and larvae, thus preventing the attack from assuming serious proportions.

Although the felled trees lying on the ground which the author assumed to be the attraction, harboured quite as many of the insects as the standing trees, it is interesting to note that the woodpeckers did not work at all on these trees.

This fact would appear to show that considerable care must be exercised in the use of trap trees for bark beetles. It is believed that the insects can be attracted by trees that have recently been killed and are known as trap trees. After they have become infested, they can be destroyed, thus materially reducing the number of insects in the forest. The presence of newly killed trees in the neighbourhood of freshly cut logs clearly shows that trap trees, as they appear to have a tendency to concentrate the beetles, must only be used with the greatest caution. G. T.

[1128]

INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE  
MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

1129 - **Development of Natural Resources in Portuguese East Africa** - HALL, H. H.  
(H. B. M. Consul General Lourenço Marques) in *Department of Overseas Trade Report on the Commercial Situation of Portuguese East Africa*, London, 1922

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

As regards agriculture, in which the country throughout is extremely rich there is great activity, particularly on the banks of the Zambesi and in the district of the Companhia de Moçambique, which is served by the port of Beira. On the Zambesi, as well as in the southernmost part of the country, sugar is produced in large and increasing quantities. The average annual amount exported during the last few years has been forty thousand tons. Some of the land under sugar-cane is said to give an average of forty-five tons of cane to the acre. In the territory of the Companhia de Moçambique land has been and is being taken up for the growing of maize, rice, tobacco, oil-seeds and other crops and for the rearing of cattle. The maize is stated to average fourteen bags to the acre. Towards the north of the country various large undertakings are actively extending coconut, sisal and other plantations, with machinery for treating the product for export. In the inland district of Tete, which lies between the Nyasaland Protectorate and Northern Rhodesia, a British company with headquarters at Capetown has quite recently started works for the manufacture of pulp from baobab trees.

Much attention has recently been paid by the Government of the country to the possibility of irrigating various suitable areas, notably in the valley of the Limpopo, where it has been found that there are about one hundred and fifty thousand acres of excellent alluvial land about forty miles from the sea, that can be irrigated, drained and protected from

floods : a small river which is navigable for small ocean-going steamers, runs some way into the area. Schemes are also being submitted for similar treatment of various areas in the valley of the Incomati River, amounting to about one hundred thousand acres in all.

A. d. B.

1130 - **Agriculture in Nigeria in 1921.** — FAULKNER, O., in *Nigeria Annual Report on the Agricultural Department for the year 1921*, 8 pp. Lagos, June 14 1922.

*Cotton.* — The American cotton bush ("Allen") was introduced from Uganda into the Province of Zaria and the neighbouring Provinces of Kans and Sokoto. Almost all the crop of 1921 in the northern Provinces, 10 000 bales, was American cotton, while in the previous year, out of an almost equal yield, there were only 5 500 bales of American cotton. The cotton is bought by the British Cotton Growing Association which paid from 1915-1916 to 1921-1922 respectively  $1\frac{3}{4}$  —  $1\frac{3}{4}$  —  $2\frac{3}{4}$  —  $2\frac{3}{4}$  —  $3\frac{1}{2}$  —  $4\frac{1}{2}$  — 2 pence per pound for unginned American cotton. The Agricultural Department encourages the development of cotton growing by distributing selected seed (about 2300 kg. in 1921) ; by inspecting the cotton brought to market stations, which is said to decrease the difference between the price offered by the British Cotton Grower's Association and that paid by agents and brokers ; by the selection of "Allen" cotton, which has already given encouraging results.

Cotton is the principal product exported from Northern Nigeria.

Cotton is very extensively grown in Southern Nigeria : in 1920-1921, 20 000 kg. of unginned lint were exported, which formed only a small part of the total output as a good deal is used by the natives for home weaving. In 1921-22, the export was only about  $\frac{1}{4}$  of that of the previous year, owing to the unfavourable season and the low price offered ( $1\frac{1}{4}$  pence per pound). In previous years the Agricultural Department had distributed seed of "Georgia" Cotton in Southern Nigeria ; in 1921, it distributed seed of "Allen" cotton (6860 qx.) brought from Northern Nigeria. This large scale experiment has not given definite results as the year was unfavourable : the inspectors at the market stations noticed some good lots of cotton grown from this seed, but much of the lint was not sufficiently ripe and was blemished.

Cultural experiments undertaken at the Moor Plantation of the Agricultural Department have not given conclusive results. The yield of the "Allen" variety was poor, but that of indigenous cottons was still less. Researches must therefore be renewed for the purpose of discovering a cotton suitable for growing in Southern Nigeria. The Department has already begun such work which includes : — Selection of native cotton ; experiments with a few good exotic cottons ; experiments to decide which is the best time for sowing.

Similar remarks apply to the Province of Florin.

*Cocoa.* — The cocoa tree was introduced into the Provinces of Calabar, Berrin and perhaps Onitoha also, long before it was of any importance for the Colony or for the old western Provinces. The quantity exported

rose from 1388 t. in 1908, to 18 232 t. in 1921, of which about 17 420 t. were exported from Lagos.

The cocoa exported from Lagos is grown very close to the coast or to the north-east of Ibadan, while in the intervening country there is little or none. This is due, among other reasons, to the climate, soil, railway, character of the people, etc., but specially to the action of the Southern Nigeria Agricultural Department: cocoa growing has only gained a footing in places where it is likely to be permanent. It is encouraged by the teaching of good methods of fermentation. Moreover, up to the March 31, 1921, 16 000 cocoa plants were distributed free of charge or sold and 272 000 beans were distributed gratis for sowing.

During 1921 the corresponding figures were 1500 plants and 5200 beans.

*Oil Palm.* — The methods which have been suggested and discussed by several authorities and commissions in agreement with the Colonial Office to increase the production of palm oil and drupes or to improve the quality of the oil are chiefly: — 1) The introduction of machinery to replace the native methods of extraction. 2) Improvement of local methods of extraction, which vary in different places. 3) Production and propagation of improved varieties. For Nigeria the first is the most and the last the least important matter; but it is the latter which has alone attracted attention.

Of the different varieties sown at the Moor Plantation, Calabar, Omitsha and Bénin have begun to bear. In all plots, except those planted with the common local variety, the palms are too few to make any estimate as to their yield. The varieties are not clearly characterised and besides those described in the text-books, intermediate forms are also met with.

*Kola nuts.* — For many years the Agricultural Department has encouraged the plantation of the "Gbanja" variety of kola, and has distributed altogether 212 000 nuts and 58 000 plants of that variety, of which 114 000 nuts and 8216 plants were distributed in 1921. The output of the southern Provinces is at present scarcely sufficient to support a regular trade, but the yield of the "Gbanja" variety which was introduced from the Gold Coast, is steadily increasing.

*Tobacco.* — Light Virginian tobacco has been grown in Florin, but up to the present time only partial success has been obtained.

*Rice.* — Ceylon swamp rice has, to a great extent, replaced local varieties in many parts of the Northern Provinces. At Pategi (Florin Province) a variety introduced from Guiana has been tested comparatively with the Ceylon rice; the results are encouraging.

*Other crops.* — A certain amount of success has been obtained, especially in the Northern Provinces, in the introduction of better exotic varieties, or in the selection of indigenous varieties of various cultivated plants, such as "guinea corn" (a variety of sorghum for grain), wheat and "coco-yams".

The Agricultural Departments of Southern and Northern Nigeria have been united into a single Department with the writer at its head.  
F. D.

1131 - **Agriculture in the State of Bahia, Brazil** (1). — BARBOSA DE SOUZA, Y. (Secretário da Agricultura, Indústria, Comércio, Viação e Obras públicas do Estado da Bahia), *Relatório apresentado ao Exm. Sn. Dr. J. J. Seabra, Governador do Estado*. Year 1920, 181 pp., 7 full page tabl. Bahia 1921.

**PRINCIPAL CROPS: Cotton.** — The "Serviço do Algodão" (Cottons Service) was instituted by Federal Decree No. 14 117 of March 27, 1920 for the encouragement of cotton growing. The "Centro Industrial do Algodão", which collaborates with the former in the control of "Lagarta rozada" (*Gelechia gossypiella*) (2), and of "Lagarta verde" helps in the same object.

**Sugar-cane.** — The crop might be much more widely grown. In 1919 and 1920 the sugar factories of the State produced 372 700 bags of sugar.

**Maize.** — This is one of the most extensively grown cereals and thrives well throughout the State. It covers about 150 000 ha. yielding about 2 100 000 qx. a year.

**Cocoa.** — Exported in large quantities this commodity forms one of the principal sources of wealth of the State. According to the "Sindicato dos Agricultores do Cacau" production reached a maximum of 814 412 bags of beans in 1918, but fell to 786 074 bags in 1919 and to 650 873 bags in 1920.

Other important crops are *tobacco, coffee, manioc, rice*, etc. The export trade is almost exclusively maintained by agricultural products. In 1920 it included: — 53 667 000 kg. of cocoa — 30 288 000 kg. of tobacco — 656 7000 kg. of coffee — 6 512 000 kg. of sugar — 2 765 000 kg. of leather and 750 000 kg. of hides — 2 525 000 kg. of "piasava" — 180 t. of timber — 58 000 kg. of rubber — etc.

The forests supply almost all the fuel (firewood and charcoal) consumed by the railways, shipping, factories and required for domestic use. Owing to heavy timber cutting the question of reafforestation arises; the writer suggests the formation of forest nurseries for this purpose.

**AGRICULTURAL ENCOURAGEMENT.** — Includes: — distribution of seeds, competitions with prizes, sales to farmers at cost price of ploughs and other agricultural implements, etc. The distribution of seeds and plants is entrusted to the "Inspeccoria do Serviço Agronomico" (Inspectorate of the Agricultural Service) and to the Bahia experimental and demonstration Staff. The seeds distributed in 1920 were chiefly garden seeds, cereals and seeds of leguminous forage plants.

**PUBLIC AGRICULTURAL SERVICES.** — These include: — agricultural stations — a station for experiments and demonstrations — a meteorological

(1) See R. July 1922, No. 681, Note (1). (Ed.)

(2) See R. Dec. 1921, No. 1306. (Ed.)



logical Service — the publication of the *Boletim de Agricultura* of the Secretariat of Agriculture, Industry, Commerce, etc. In 1920 about 1200 copies were distributed.

The cadastral map is being compiled; this is entrusted to the "Serviço de Terras" of the "Diretoria de Terras e Minas".

**AGRICULTURAL EXPERIMENTS.** — These are entrusted to the "Campo de Experiencia e Demonstração Dr. Antonio Moniz" at Bahia, the area of which is about 4.5 ha. In 1920, many varieties of pulse, cereals, forage plants, industrial plants, pot-herbs and vines were tried. Among other things it was noticed that the "Bento Vieira" variety of manioc could occupy the ground for 10 years and produce enormous roots which reached a length of 2.80 m. and weighed as much as 13 kg.

The "Florida beggar weed" (*Desmodium tortuosum*) did very well and its propagation in Brazil as a forage plant and green manure has consequently been recommended.

**AGRICULTURAL INSTRUCTION.** — Is entrusted to the "Aprendizado Agrícola Federal" of Villa de São Francisco and to the "Escola Agrícola S. Bentos das Lages" of Villa de São Francisco, founded in 1859, which confers the diploma of "engenheiro agrônomo".

**BREEDING.** — According to official statistics the State of Bahia contains: — 2 683 000 cattle — 825 000 horses — 587 000 donkeys and mules — 3 005 000 goats — 2 224 000 sheep — 2 410 000 pigs. The cattle and sheep are bred for slaughter.

There is a Federal Veterinary Inspectorate ("Inspectoria Federal de Veterinaria") in the State. Good breeding animals are to be purchased shortly and sold to breeders at cost price in order to found "Postos zootécnicos" (Zootechnical Stations), serving stations and to arrange for dipping.

**MEANS OF COMMUNICATION.** — 2000 km. of railway are in use and 400 km. are under construction and plans for the construction of 1700 km. have been approved.

The river and coastal shipping is subsidised by the State. The construction of about 350 km. of roads has just been undertaken.

The building of important hydro-electric power stations (on the Paraguaçu, Jaguaripe, Itahipe and the Una) has made it possible to begin the construction of electric tramways and telephone lines.

**COLONISATION AND IMMIGRATION.** — The State of Bahia took part in the recent negotiations with the Italian Government with the object of encouraging immigration to its territories, where agriculture can be considerably developed.

F. D.

1132 — **Destruction of Mosquitoes by Eels** (1). — DUBOIS, R., in *Comptes rendus hebdomadaires des séances de l'Académie des sciences*, Vol. 173, No. 10, pp. 431-432. Paris, Sept. 5, 1922.

RURAL  
HYGIENE

From experiments made by the writer it was found that young eels live well for a long time in very impure water and that in such water they

(1) See R. March 1920, No. 282 and Feb. 1921, No. 118. (Ed.)

are very active in destroying the larvae of mosquitoes, and possibly also the eggs of several intestinal worms. They are so voracious at the commencement of spring that the writer no longer found any anopheles larvae in ponds where there had been large numbers before the eels were introduced.

The writer thinks that it would be very advantageous to keep young eels in all waters containing larvae of mosquitoes, both in the case of drainage water and other very contaminated waters. The exceptional hardiness of these fish, their low cost, the facility with which they can be caught and transported in large numbers, make them preferable to gold-fish (which have been recommended for killing larvae) and suggest that they would be very useful for the control of malaria by natural means.

F. F.

AGRICULTURAL  
EXPERIMENT

1133 - **Effect of Aluminium Salts and of Acids in various Strengths on the Development of Plants in Water Cultures** (1). - CONNER, S O and SEARS, O II (Purdue University, Agricultural Experiment Station), in *Soil Science*, Vol XIII, No. 1, pp 23-33, 1 fig, 1 full page tabl, bibliography of 8 publications, New Brunswick, N. J. Jan 1922

In spite of the large amount of literature dealing with the effects of aluminium salts and acids on plants grown in water, it has not yet been possible, owing to the great variety in the methods used, to compare the results obtained.

In 1919 the writers made a series of experiments on this question on rye, maize and barley grown on sand and then transferred to TOTTINGHAM nutritive solutions. The following substances were experimented with: - nitric acid, sulphuric acid, hydrochloric acid, phosphoric acid, tartaric acid and the respective aluminium salts at 4 different strengths, (N/ 600, N/ 1200, N/ 2400, N/ 4800); sulphate of aluminium mixed with phosphoric acid and the three phosphates of lime (N/ 600); sulphate of aluminium mixed with silicic acid, silicate of lime; carbonate of lime and of magnesium; dextrose; mannite; glycerine and carbon. Equal strengths of the various salts and acids show the same degree of toxicity in cultures of rye and barley. When the plant was well developed, the acidity of the solution decreased considerably. Nitric, sulphuric and hydrochloric acids and the respective salts showed the same toxicity; tartaric acid was less toxic and phosphoric acid least of all. Other cultures were made in SHIVE's nutritive solutions  $R_4 C_5$  of various osmotic pressures (0.0025 atm.; 0.1; 0.4). With the strongest solutions there was greater growth and consequently greater change in the acidity. By treating rye, barley and maize in SHIVE's solutions with sulphuric acid and sulphate of aluminium and by changing the solution every day so as to have pH constant, it was found that at parity of pH, the acid is much more toxic than the salt. In the bottles containing the salts a varying quantity of precipitate was also found. On the other hand in HARTWELL's and PEMBEL's nutri-

(1) See R. Aug 1922, No. 813. Sept. 1922, No. 909 and No. 910. (Ed.)

tive solutions, which contain much less phosphate in proportion to the other elements, sulphate of aluminium showed itself much more toxic to barley than sulphuric acid of similar strength, and slightly more toxic to rye.

As the plant grows these nutritive solutions tend to become more acid.

We may conclude by stating that the toxicity of aluminium salts is due rather to the aluminium ion than to the hydrogen ion in the case of plants similar to barley, and that this toxicity decreases considerably by adding much phosphate to the nutritive solution. These results confirm the theories of HARTWELL, PEMBEI, and MIYAKA. The toxicity of acid soils is due in a great measure to their content of soluble salts of aluminium.

A. de B.

## CROPS AND CULTIVATION

1134 - **Effects of a dry, warm Year on Wheat Crops grown at Verrières.** — DE VILMORIN, J., in *Comptes rendus de l'Académie d'Agriculture de France*, Vol VIII, No 9, pp 311-312. Paris, March 1, 1922.

AGRICULTURAL  
METEOROLOGY

The meteorological conditions prevailing in 1921 caused a remarkable growth, rarely observed in a normal year, in a large number of southern varieties grown in the climate of the environs of Paris.

At Verrières the southern varieties of wheat, under the exceptionally warm temperature, took a place in the classification which is rarely attained by them. The order of classification of wheats at Verrières in 1921 is as follows:

Three new crosses, not yet propagated and sown on a large scale. 1) (Melbor × Grosse tête × J. P. × Alliés) — 2) (Grosse tête × Melbor × Hérison sans barbes) — 3) (Hâtif Inversable × Alliés); — three southern varieties Riéti — Bladette de Besplas — Rouge prolifique barbu, — a hybrid under examination: Wilhelmine wheat.

The Blé de la Paix, a new large-yield variety, is classed twelfth; the Inversable, thirteenth, and the Gironde, fourteenth.

Wheats belonging to cold regions, such as the Altkirch and Rouffach, also felt the influence of the season. They are classed 32nd and 36th only.

The best yields, obtained on cultures of transplanted wheat were as follows (in kg. per ha.): Melbor × Grosse tête × J. P. × Alliés, 18 190 — Grosse tête × Melbor × Hérison sans barbes, 17 885 — Hâtif Inversable × Alliés, 17 215 — Riéti 16 600 — Bladette de Besplas, 16 580 — Rouge prolifique barbu, 16 545 — Croisement composé (Mixed Cross), 16 500 — Wilhelmine, 16 430.

F. D.

1135 - **The Treatment of Soil with Ferrous Sulphate and its Influence on the Soil Solution obtained by the Lipman Pressure Method** — LIPMAN, C. P. (University of California) in *Soil Science*, Vol XIII, No 1, pp 55-56 New Brunswick, N. J., January 1922.

SOIL PHYSICS

The author applied ferrous sulphate to the soil of a lemon orchard and after an interval of several weeks took samples of the soil, from which he extracted the soil solution by the pressure method. On analysis this solu-

tion was found to differ in a marked degree from that obtained from land not treated with ferrous sulphate. The sulphate of iron had increased considerably the content of non-volatile solids in the soil solution and had precipitated dissolved organic matter. The iron had substituted itself for the common bases, calcium and potassium, and had increased the amounts of phosphorus, potassium and calcium in solution. A. de B.

**1136 - Zinc as a normal Constituent of Soil under Cultivation and of Plants. —**

MONTANARI, C, in *Le Stazioni sperimentali a varie italiane*, Vol. LIV, Nos. 7, 8, 9, 10, pp. 278-283, bibl. of 9 works. Modena, 1921

The presence of zinc in plants was discovered about 50 years ago by RAULIN, but it was only in 1911 that DELEZENNE proved the importance and wide diffusion of this metal in the various animal and plant tissues. The writer, repeating the experiments with the improved DELEZENNE method, examined about 10 soils in the Province of Pavia stretching from the left bank of the Po to the Apennines. Although they differed greatly in their mineralogical character, he found considerable traces of zinc in every one of them, the amount being from 7 to 11 mgm. per kg. of dry soil. Nothing certain is known yet as to the function of zinc in plant life. According to MAZI, it is indispensable to the growth of maize, and its absence would cause acute chlorosis.

The writer tested the chlorophyll extract of spinach for zinc, but the result was negative. The matter from which the chlorophyll had been extracted was however rich in zinc, viz., 25.3 mgm. of zinc per 100 gm. of dry matter in spinach leaves. It still has to be decided what plant organs contain the largest quantity. DELEZENNE believes that zinc exercises special catalytic action in connection with the function of chlorophyll and with the circulation and metabolism of complex organic substances.

A. de B.

**1137 - Base Exchange and Alkalinity in Egyptian Soils. —** PRESCOTT, J. A., in *The Cairo*

*Scientific Journal*, Vol. X, No. 106-107, pp. 58-64, bibliography of 15 works. Cairo, May 1922

The presence of sodium carbonate in the soil solution is one of the most frequent causes of infertility in Egyptian soils, although the areas affected are not usually extensive.

Sodium carbonate is one of the most difficult of soil constituents to determine; variations of 400 % may be obtained in analysis according to the method adopted. No extract of this substance can be obtained even with 40 % alcohol; the maximum quantities are obtained by a fairly low proportion of soil to water (1 : 20) and extraction at the temperature of boiling water. The only constant value is the hydroxyl ion concentration. Normal Egyptian soils and the original Nile silt are faintly alkaline (pH = 8).

In the author's opinion, the origin of sodium carbonate in Egypt is to be attributed to the reversible reactions between neutral salts, and zeolites and kindred compounds. The Nile alluvium contains more than 2 % of salts (chiefly an aluminosilicate complex, probably colloidal in character)

which can react with neutral salts by base exchange. The soil of Bahtim contains at least 10 % of such salts.

The author carried out a series of experiments which fully confirmed the truth of his theory. Fifty grammes of good Bahtim soil containing no sodium carbonate, only about 0.1 % of bicarbonate, and having a pH of 8.2 were treated with a 10 % solution of sodium chloride, and subsequently washed with alcohol. This treated soil sample gave on analysis 0.344 % sodium carbonate and 0.462 % of bicarbonate; its pH was 9.3. It had thus become similar to one of the worst cases likely to be found in cultivated land.

A. de B.

1138 - **Determination of the organic Matter in the Soil.** — BOUDORFF, K A., and CHRISTENSEN, R H., in *Tidsskrift for Planteavl*, Vol XXVIII, No 2, pp. 265-275 Copenhagen, 1922

After having completed the experiments, of which an account has already been published, which were made by CHRISTENSEN on the power of the soil to decompose mannite, the writers made preliminary investigations on the possibility of determining directly the mannite content of soil extracts. The results showed that the method employed up to the present for determining organic substances in soil extracts is not entirely satisfactory since the oxidation of the greater part of the mannite present does not allow a quantitative analysis. A special experiment made on the subject indicated that such analysis can only be carried out when a large excess of permanganate is present.

In consequence of the results obtained the writers recommend the following modifications.

Place a soil extract containing 0.25 gm. of soil in a glass with 50 cm. of diluted sulphuric acid (6. 200). Heat for 20 minutes in a dish, add 50 cm. of a normal  $\frac{1}{20}$  solution of oxalic acid and titrate with a normal  $\frac{1}{50}$  solution of permanganate of potash

A. de B.

1139 - **Partial Sterilisation of the Soil.** — RIVIERE, G., and PICHARD, G., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol CLXXIV, No 7, pp 493 495 Paris, Feb 13, 1922

If arsenite of soda be added to a soil a great change takes place in its microbial flora and fauna. If the doses of arsenite of soda are below a certain limit (about 10 gm. per sq. m.), the higher plants do not suffer in any way, whereas the protozoa, which destroy the useful bacteria, die in large numbers.

Both before and after the war, the writers made experiments on 10 ha. of different soils, using various plants and their results are as follows: 100 kg. of arsenite of soda per ha. destroy the protozoa, but have an injurious effect on the higher plants; a dose of 21 to 42 kg. per ha. (= 2-4 gm. per sq. m.), does not injure them but encourages the growth of useful bacteria and has an indirect influence on yield, which is increased from 20 to 50 %. Owing to the low price of arsenite of soda it can be advantageously used for partially sterilising the soil in order to obtain more

abundant yields, without any temporary necessity for the addition of nitrogen fertilisers.

A. de B.

**1140 - Action of Carbonic Acid Liberated by Micro-Organisms in Improving Arable Land.** — STOKLASA (Professor at the Higher Technical School of Agriculture at Prague) in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 8, No. 21, pp. 594-596. Paris, June 7, 1922.

The writer has studied the physiological functions of soil bacteria for 25 years; he first observed that fertility is in direct ratio with the number of bacteria contained in the soil, whatever be the nature of these bacteria. The best soils are always characterised by the presence of a large number of bacteria and, consequently, by great biological activity.

As this activity is manifested by respiratory changes — the liberation of carbon anhydride and the absorption of oxygen — it can be easily measured. The writer has constructed a special and very practical apparatus for this purpose. He measures the quantity of carbon anhydride liberated from 1 kg. of arable soil. In soils of medium fertility he found that in a layer 36 cm. thick, 1 kg. of soil liberates 30 mg. of carbon anhydride in 24 hours, which, in 5 million kg. of clayey soil, amounts to 150 kg. of carbon anhydride per day, and for 200 days growth in the year, 15 million kg. of carbon anhydride. This gas dissolves in the water contained by the soil and, in circulating, plays an important part in transforming insoluble mineral salts into soluble matter, especially phosphates and in a secondary degree, silicates; it also acts on the cations, transforming them into carbonates easily absorbed by the roots, which greatly increases the chlorophyll assimilation of the carbon. And as the absorption of the other elements (nitrogen, sulphur, phosphorus, hydrogen, oxygen, potash, calcium, magnesium, iron) is in constant ratio with the assimilation of carbon, it follows that plant nutrition and growth are greatly aided.

The respiration of the micro-organisms also causes a rise in the temperature of the soil which, for a depth of 10 — 30 cm. rises 1 — 2° C, or 4 — 8 million calories per ha., which should greatly influence the growth of the roots of plants.

Good results may be obtained by chemical fertilisers — nitrates, superphosphates, etc., and certain catalytic substances — but for a maximum yield the plants must also be supplied with carbon, in the form of carbonic acid; there is only one way of doing this, namely, by increasing the biological activity of the bacteria by means of biological fertilisers.

I. V.

**1141 - The Influence of Plants upon Oxidation Processes in the Soil.** — NELLER, J. R., (New Jersey Agricultural Experiment Station), in *Soil Science*, Vol. XIII, No. 1, pp. 139-158, Plate 1, bibliography of 66 works. Baltimore, March 1922.

The symbiotic relationship between leguminous plants and bacteria was established only after years of investigation. It is probable also that in the soil relationships of another nature exist between micro-organisms and plants. Certain germs may function more actively in the immediate vicinity of roots and may benefit the plants. The author's studies give

him reason to believe that some such relationship exists between oxidising bacteria and growing roots. The processes of oxidation which take place in the soil under the influence of micro-organisms are made evident by the formation of carbon dioxide. It thus becomes a question of ascertaining whether growing plants have any influence upon the rate of oxidation of soil organic matter.

The author gives a very thorough account of the records of research on this matter which helped to explain soil oxidation, especially those concerning nitrification and the influence of plants on oxidation. It is necessary to recall the work of SCHREINER and SULLIVAN ; TURPIN ; LAWES, GILBERT and WARINGTON ; KING and WHITSON ; FRAPS etc. The influence of plants on various nitrifying bacteria was recognised by BERTHELOT ; HEINZE ; BROWN ; that on bacterial flora in general by CARON ; STOKLASA and ERNST ; LECLAIR.

The investigations are not always in agreement and some even are contradictory, but, as RUSSELL stated, field experiments alone do not enable us to decide this question and the systematic laboratory investigation has still to be made. It was for this reason that the author considered that a review of the problem might be of value.

The carbon dioxide liberated by bacteria in the soil in the presence of plants is not always that which is available for direct estimation. As a matter of fact part of this is absorbed by the roots and used in photosynthesis. It is necessary to keep this in mind, as this carbon dioxide is in addition to that obtained by the leaves from the atmosphere, and there is no way of separating them. The author got over this difficulty by placing the soil and growing plants in enclosures through which air freed from carbon dioxide was drawn. Thus the only source of carbon dioxide within the enclosures was that produced by the soil bacteria, of which part was absorbed by the roots and part utilised in the photosynthetic process in the leaves. The carbon dioxide not taken up was drawn through absorption towers and estimated, and that fixed in the process of photosynthesis was determined by making a total carbon analysis of the plants.

Thus the total amount of carbon dioxide produced by micro-organisms was measured quantitatively. Allowance should be made for the small amount of carbon present in the seeds or young plants used in the experiment. Another sample of soil under identical conditions but without any plants served as a control. The difference between the quantities of carbon dioxide produced in the two experiments must be attributed to the greater or less activity of soil bacteria in the presence or absence of plants.

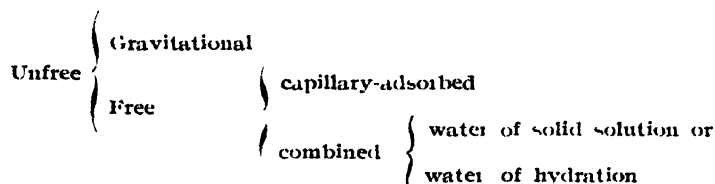
In one of these experiments a soil was used composed of white sand to which was added 10 % of a fertile loam. As compared with the control, soya beans gave an excess of 12.1 % carbon dioxide, wheat 25.2 % and barley 12.9 %. In another experiment an ordinary fertile soil was employed and the difference in carbon dioxide production was even more striking ; for soya beans it was 66 %, peas 70.8 % and for buckwheat 116.5 %. The author repeated the experiment, using the same soil again and obtained

in the case of a jar planted with soya beans, an evolution of carbon dioxide 66 % higher than that from unplanted soil.

The experiments thus show that growing plants have a beneficial influence upon oxidation activities in the soil, and suggests a symbiotic relationship between the soil oxidising organisms and the plants. L. V.

1142 - **The Classification of Soil Moisture.** — PARKER, F. W. (University of Wisconsin), in *Soil Science*, Vol. XIII, No 1, pp. 43-54, Figs. 4, bibliography of 22 publications New Brunswick, N. J. Jan 1922.

Soil moisture is generally classified under three forms, as hygroscopic, capillary and gravitational water. Recently BOUYOUKOS advanced the hypothesis that a portion of the soil water is inactive or unfree, and does not act as a solvent and suggested a new classification.



The author subjected this theory to experimental tests and found it to be inexact. The lowering of the freezing point is far greater than that indicated by the law of inverse proportions and is due to the presence of solid matter and not to the existence of inactive water. Experiments show that solid matter causes a freezing point depression of water, benzene or nitrobenzene in the film or capillary condition. If one part of the water absorbed by the soil became inactive, a solution added to the soil ought to become more concentrated; but this was not the case when tests were carried out with solutions of alcohol or glycerine. A number of investigators have shown that the water of certain inorganic hydrogels is not combined water. However these hydrogels contain a considerable amount of water which cannot be frozen and a still larger amount which would be regarded as unfree water under the new classification.

Experiments on the rate of evaporation of water from soils, the vapour pressure at different moisture contents, the equilibrium relations with seeds and the freezing-point depression due to solid material do not indicate the presence of different forms of soil water such as are given in the classification of BOUYOUKOS. The results obtained can be explained in the following manner. In the case of soil not fully saturated with moisture, the water is held to the soil particles by the force of adhesion. If the quantity of moisture decreases, the force of adhesion of the remaining water increases, and this causes a lowering of the freezing point, a diminution of the rate of evaporation and a decrease of vapour pressure. This force of adhesion is sufficient to prevent the water from freezing even at a very low temperature.

The water present is subjected to the same law over the whole experi-



mental field and the constant and critical points shown by the soil and varying degrees of water content are equilibrium values only and do not indicate any break in the physical condition of the soil moisture.

The old classification of soil moisture into hygroscopic, capillary and gravitational water is retained, notwithstanding certain objections, and may be regarded as at any rate, very useful.

A. de B.

1143 - **Experiments in the Improvement of Alkaline Soils by the Application of Gypsum and other Methods.** — HIBBARD, P. L. (Agricultural Experiment Station, University of California), in *Soil Science* Vol. XIII, No. 2. Baltimore, February 1922.

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The author describes several methods employed to restore the fertility of the land belonging to the University of California, which was formerly very productive, but now bears next to nothing owing to the large alkaline deposits. From 1914 to 1918, attempts had already been made to improve extensive tracts by means of drains intended to carry off the salts in solution; the results obtained were however far from encouraging. In 1919, a detailed study of the district was begun and one ton of material from each of the five localities to be studied was examined. It had been intended to treat the soils with gypsum only, but as this did not prove effective, several other methods were adopted. The results obtained were as follows:

By means of simply washing the soil with water, the excess salts could be removed. A soil which is exceedingly alkaline owing to the presence of sodium silicates, carbonates, or bicarbonates can be improved to a certain degree by the application of gypsum, but fertility is only insured by the immediate leaching action of water which washes the alkalis, and especially the salts, down to the lower layers, thus making it possible for the seeds to germinate in the upper layers which otherwise would have remained toxic.

A rise in the carbon dioxide content of the soil air decreases the alkalinity, and allows plants to grow. This can be obtained without difficulty by introduction of organic substances that decompose readily.

When a soil contains more than 0.5 % of sodium carbonate and other sodium salts, it is difficult to make it fertile by the application of gypsum, because the reaction between gypsum and sodium carbonate is reversible. In order to check the inverse reaction, the sodium salts in solution must be removed by drainage, for owing to the slight solubility of gypsum (about 0.25 %), it is useless to try and affect the direction of the reaction by increasing the proportion of this substance. Before the alkalinity of the soils is reduced by leaching, a flocculating agent such as gypsum or calcium bicarbonate should be added to prevent the formation of impermeable, puddled layers. Water containing sodium carbonate or bicarbonate should never be employed.

When the sodium chloride and sulphide are removed from a soil by leaching, a perceptible rise in its alkalinity, or a fall in its pH value, is often observed. The alkalinity may be sufficiently high to be toxic to plant life, but as a rule, the amount of alkalis present is so small that the

little carbon dioxide liberated by plants or produced by decomposing organic matter, suffices to keep it below the toxic limit.

A. de B.

1144 - **Injurious Action of Composts.** — PETIT, M. A., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 171, No. 21, pp. 1362-1364. Paris, May 22, 1922.

In this article, the writer describes some experiments made to find out and study the causes why composts are injurious to the growth of certain plants.

It had previously been proved that these composts after washing acquired a higher fertilising power. The writer observed that certain plants, *e. g.*, the *Primula obconica*, derive no benefit from this washing, while others, such as the hybrid cineraria, suffer from it. This is explained by the fact that the washing not only gets rid of injurious substances, but also carries away soluble matter which is easily assimilated. In the experiments made with the hybrid cineraria it was also observed that composts of recent formation, in which the process of denitrification is still active are more injurious than those of older formation.

Certain calcifugous plants, such as the ericaceous group (azaleas, rhododendrons, etc.), suffer from the addition of composts to the soil, even in slight doses. This, as the writer has proved by his experiments, should be attributed not only to the small quantity of carbonate of lime (1-1.21 %) always present in the composts but also partly to the action of injurious soluble substances. Indeed, the wrinkled calceolaria, for instance, becomes chlorotic in soil containing 1.21 % of carbonate of lime, whereas it remains green in one rich in humus and containing 2.56 % of limestone. The writer has also observed that the addition of ferrosulphate to unwashed compost in the proportion of 2 to 3 ‰, neutralises the injurious action (chlorosis) of this compost on certain plants, *e. g.* on the hortensia (*Hydrangea Hortensia*) and the wrinkled calceolaria. The beneficial action of ferrosulphate should be attributed exclusively to the iron; the addition of other sulphates (sulphate of potash, of aluminium and of manganese) had in fact no effect.

It was also observed that the use of washed compost has a beneficial influence on certain plants (the hortensia and calceolaria) only for a certain period, and that the same thing takes place when washed compost to which iron sulphate has been added, is used. After a certain time the plant begins to become yellow, and, to avoid chlorosis, a fresh dose of ferrosulphate is necessary. The writer comes to the conclusion that injurious soluble substances are continually forming during the decomposition of the compost.

Finally the writer has tried mixtures of compost and sand in varying proportions up to equal parts, without any satisfactory result. He obtained good results, on the other hand, by mixing with clayey soil. Very probably the clay with its very high absorbing power fixes the soluble substances which are injurious to plants.

The writer draws special attention to this last observation made in

the course of his experiments, because it shows the great importance also of the physical composition of the soil which is chosen for the preparation of fertilising mixtures.

L. M.

1145 - **The Value of Tetraphosphate as a Fertiliser** (1). — HUDIG, J. and MEIJER C., in *Verslagen van Landbouwkundige Onderzoekingen der Rykslandbouwproefstations*, No. XXV, p. 140-159, 8 figs. Gravenhage, 1921.

The authors describe the circumstances which led to the starting of the tetraphosphate industry, the methods of manufacture and the success or non-success of this war-time fertiliser up to the present day. The fertiliser does not require sulphuric acid in its preparation and any quality of phosphates can be used, even such as are not suitable for the manufacture of superphosphates.

After referring to the reports of MENOZZI and BELLUCI, the authors describe the investigations they have made respecting the value of tetraphosphate. The first experiment was made with oats grown in pure sand, in pots; these were given, as fertilisers, chloride of potash and magnesium sulphate; one set of these cultures were given nitrogenous fertiliser in the form of nitrate of soda and the other nitrate of ammonium. The eight pots of each of these two sets received respectively as phosphatic manure: phosphate soluble in water — phosphate only slightly soluble — insoluble phosphate — low grade crude phosphate — high grade crude phosphate — the same high grade crude phosphate, heated to 700° C and rapidly cooled — tetraphosphate — no phosphate at all. These experiments have shown that in a slightly acid medium, tetraphosphate and the two other crude phosphates are of value. The favourable results obtained with tetraphosphate on rice plantations may probably be attributed to the acidity of the soil. The fact that MENOZZI obtained unfavourable results was probably due to the fact that the soil used in his experiments contained a sufficiency of phosphates, or to its alkaline reaction. The cultures failed when grown in an alkaline medium with crude phosphate.

A second study was made by the authors by carrying out comparative field experiments with 17 % superphosphate, 18 % French, Somme phosphate and tetraphosphate containing 26 % of phosphoric acid. These trials showed that:

- 1) in alluvial soils tetraphosphate and Somme phosphate were equivalent, although in sands of the "Anna-Paulownapolder" tetraphosphate was superior to French phosphate.
- 2) in "roodoorgrond" super and tetraphosphate gave an increase of 13 % in yield;
- 3) in the 22 cultures in sandy soil which responded to tetraphosphate, 6 gave a better yield with the tetraphosphate than with Somme phosphate; of these 6 cultures, three gave higher yields with tetraphosphate than when super was used; in the remaining three cases the two fertilisers proved to be equally effective.

(1) See R. 1916, Nos. 35, 1063; 1920, No. 498; 1922, No. 385. (Ed.)

These results were obtained with cultures of red clover, lupins, peas and oats. On the other hand with cereals and potatoes, 4 instances were recorded in which tetraphosphate was inferior to crude phosphate.

The authors summarise their work as follows :—

1) In sandy soils which had received a manure with an alkaline reaction tetraphosphate did not give such good results as ground, crude phosphate, and was decidedly inferior to soluble phosphate.

2) In sandy soils to which had been added a manure with an acid reaction, tetraphosphate gave good results ; the best however were those with crude, ground phosphate. The yield with tetraphosphate was the same as that obtained with soluble phosphate

3) In the cases where tetraphosphate proved superior to superphosphate the result must be attributed to the acidity of the soil, which caused the superphosphate to be ineffective and to certain unknown factors in connection with plant requirements and soil reactions.

F. S.

1146 - **Various Grades of Basic Slag in Great Britain.** — I *The Journal of the Ministry of Agriculture*, Vol XXIX, No 6, pp 530-533 London, September 1922 — II ROBERTSON, G S (D Sc, F I C), Field Experiments with Rock Phosphates and Basic Slags, *Ibidem*, pp 519-530, figs 5 — III JURITZ CHAS, F M A (D Sc, F I C Chief Division of Chemistry), Basic Slag, the Change in its Composition *Journal of the Department of Agriculture*, Vol V, No 1, pp 76-79 Pretoria, July 1922

The Permanent Committee appointed in Great Britain by the Ministry of Agriculture to study the question of basic slag presented a report in 1921, and have now presented a second, in which they examine the situation and give an account of the experiments that have been carried out

The demand for ground basic slag by the farmers of the United Kingdom has increased since the pre-war period (1912) from 290 000 tons to some 400 000 or 500 000 tons (with a phosphate content of 11 000 000 to 12 500 000 units) per annum, and will probably still further increase, as is shown by the following figures

	Consumption		Deliveries year ending May, 31		Expert estimate of the quantity that could be consumed	
	pre war (1912)	1919	1920	1921	Sir T. H. MIDDLETON	Sir A. D. HALL
	tons	tons	tons	tons	tons	tons
England and Wales.	—	433 000	407 000	328 000	890 900	975 000
United Kingdom . . .	290 000	529 000	503 000	400 000	(32 820 000 units)	(37 050 000 units).

On the other hand, the production of unground basic slag has not increased correspondingly. Prior to the war, it was about 400 000 tons, rising in 1919 to 1920 to 701 000 tons, but in 1920-21 falling again to less than 400 000 tons. Moreover, there was a reduction in quality in consequence of the substitution of the acid OPEN HEARTH process for the BES-

SEMER process. The slag now obtainable contains on an average only half the percentage of phosphate present in pre-war days, and much of it shows reduced solubility according to official tests.

The demands of the farmer have been met to some extent by importation from abroad. Thus, while in 1913 the balance of exports over imports was 114 000 tons, in 1920 and 1921 it was respectively 6000 and 38 000 tons. Export was however in these years prohibited except by licence. In view of the probability that the quality of the basic slag manufactured on the continent may deteriorate as it has in the United Kingdom, by the gradual substitution of the OPEN HEARTH for the BESSEMER process, it would be unwise for British farmers to rely to any serious extent on importation.

Further, after careful investigation it appears that little if any change in actual engineering processes is likely to improve either the output or quality of slag. From the point of view of steel manufacture basic slag is relatively unimportant, on the average rather less than 4 cwt. are obtained per ton of basic steel produced, and while a ton of steel has been worth from £27 in 1920 to £17 in 1921, the 4 cwt. of slag are not worth more than 2s. to the steel-manufacturer and only about 6s. on the market. The steel-maker therefore cannot afford to lengthen his processes or make them more costly or hazardous.

The quality of basic slag is determined by the process employed, and the total amount producible is regulated by the demand for steel, neither of these factors can be influenced to any appreciable extent by the requirements of the farmer.

The Committee have examined the possibility of substituting ground mineral phosphates for basic slag and of increasing their effectiveness. One of the slags tested in the field in 1921 gave considerably better results than could have been expected from its chemical composition. Other experiments in the same direction are now in progress. A typical North Ayrshire mineral phosphate is included in the Rothamsted trials, and the experiments carried out in various countries are being repeated at the Rothamsted Station.

Owing to the exceptionally severe drought in 1921, very few results were obtained in any of the field trials, but in any case the trials must extend over several seasons before definite conclusions can be reached.

So far as present information goes, it may be stated that: a) The highly soluble OPEN HEARTH basic slags have the same agricultural value per unit of phosphoric acid as the old BESSEMER slags.

b) The slags of low solubility have a lower value, but in some circumstances the difference is not very marked. There is however considerable difference in the effectiveness of this group which is probably due to the fact that it is composed of materials of very different nature, although the citric solubility test fails to distinguish satisfactorily between them.

c) The mineral phosphates also have a lower value, but in some cases, they are worth more than might have been expected.

As a result of these trials, the Committee hope to be ultimately able to :

1) Map out the country into regions where the high soluble slag can and cannot be replaced effectively by low soluble slags and mineral phosphates.

2) Advise the Ministry whether the annual output of very low grade slag (under 15 % phosphate) which amounts to some 70 000 to 140 000 tons, could not be used with advantage after being mixed with mineral phosphates.

The Committee are further of opinion that the official solubility test needs revision.

II. — The author examines the various kinds of basic slag, and the phosphates that could be used to replace them, and describes the experiments made in this direction.

The basic slags now obtainable may be divided into three types: —

1) *High Grade*, containing from 33-42 % of phosphate. Part of this supply consists of the rapidly diminishing remnants of the Basic Bessemer Slag, and this class will probably completely disappear.

2) *Open Hearth Basic Slag* containing from 15 to 32 % of phosphate.

3) *Open Hearth Fluorspar Slag* containing from 15 to 32 % of phosphate.

Types 1 and 2 have a citric solubility of 80-95 % and are of equal value per unit of phosphate. Type 3 has a citric solubility of 6-50 %, and it is this type of slag that is of uncertain value, for it cannot be distinguished by appearance. How much of the present supply belongs to this type it is impossible to say, but the proportion is likely to increase in the future.

One of the possible substitutes for the old type of basic slag is ground mineral phosphate. The various rock phosphates are not identical in character — they differ in their phosphate content, which is usually high, in chemical composition, and citric acid solubility which is intermediate between that of types 1 and 2 and of type 3. Experts however differ as to the extent to which citric solubility may be taken as a measure of the relative value of the various phosphates. The following table gives the principal rock phosphates with their characters:

Name of Phosphate	Origin	Approximate Phosphate content %	Citric Solubility %
Gafsa . . . . .	North Africa . . . . .	56-64	38
Egyptian . . . . .	" " . . . . .	56-60	35
Algerian . . . . .	" " . . . . .	58-66	33
Florida Soft . . . . .	United States . . . . .	48-54	27
Tunisian . . . . .	North Africa . . . . .	54-60	24
Tennessee . . . . .	United States . . . . .	30-60	23
Nauru . . . . .	Oceania . . . . .	82-88	21
Makatea . . . . .	Oceania . . . . .	82-86	19
Florida Pebble . . . . .	United States . . . . .	70-76	18

Several experiments were made in Essex from 1915 to 1919. Three types of basic slag were used and several rock phosphates and superphosphates. Meadow land poor in phosphoric acid was selected for the trials, and eight experimental centres were laid down, the following soil formations being represented: London Clay, Boulder Clay and Chalk. Other experiments were carried out in North Ireland on different types of arable land land.

#### CONCLUSIONS FROM THE FIELD EXPERIMENTS.

1) Open Hearth Fluorspar basic slags are not as effective as the soluble types. They have however a considerable value and are more effective than the solubility figures would suggest. Where the rainfall is high and the soil sour, they are nearly as good as the more soluble types, but where the conditions are reversed, their inferiority is more clearly marked. For the manuring of grassland the author is of opinion that if the value of the highly soluble slags is taken as 100, the fluorspar basic slags have a value of 50-70.

2) The results of all the experiments agree in showing that rock phosphates have a higher manurial value than has hitherto been supposed. On sour soils and when the rainfall is high, they may even prove superior to the best grades of basic slag. In all cases, they have proved more effective than the fluorspar slags. Of the various types of rock phosphates Gafsa seems the most suitable for direct application. On sweet soil or where the rainfall is low the more soluble types of North African phosphates (Gafsa, Egyptian, Algerian and Tunisian) are superior to the richer, but less soluble and harder types, such as Florida Pebble.

III. — The author gives a short account of the work and findings of the Committee. He examines the possibilities of improving the lowest grades of slag by their reintroduction into the blast furnace, and excludes the idea that other constituents such as manganese can have any value in improving the quality of basic slags. He quotes the opinion of Dr. F. J. RUSSELL, the President of the Committee, who stated on the subject of basic slags that though types with high solubility come into action more quickly and produce a larger return the first season, the low soluble slags may increase in effectiveness, so that after 5 years there may be little difference between the two.

A. de B.

1147 — **Potassic Deposits in Poland.** — *Les Mécuriales Agricoles*, Vol. VI (Second series), No. 18, p. 138. Antwerp, May 5, 1922.

Potassic salts have hitherto been worked in Poland only in the neighbourhood of Kalusz in Galicia, but there is reason to believe that potassic deposits exist in other regions of Galicia and notably in the vicinity of de Bochnia and Wieliczka.

Prof. MICHAELIS is of opinion that beds of potassic salts are also to be found in Posen; these would form the extension of corresponding deposits in Germany.

The output at Kalusz used to be extremely small, the total extraction (in tons) being only.

1913	1919	1920	1921 (6 months)
2 344	2 500	10 293	6 737

The amount extracted in 1921 was at least six times larger than the pre-war out-put, but it will only satisfy a small fraction of the requirements of Poland, which country must for the present remain dependent upon foreign sources for its supply of potassium. A. de B.

**1148 - Pot Culture Tests on the Availability of Potassium in Greensand Composts.** - SMITH, A. M. Agricultural Experiment Station, College Park, Maryland), in *Journal of the Association of Official Agricultural Chemists*, Vol V, No. 1, pp. 133-136 Washington, D. C., August 1921 (1).

The author describes experiments made by himself with a view to ascertaining the possibility of the use of glauconite as a fertiliser. This mineral, which is commonly known as greensand, consists chiefly of the hydrous silicate of iron, aluminium and potassium. It forms extensive deposits in New Jersey, Maryland and Virginia; the present investigations have therefore great practical importance for these States. Greensand can be applied to soil either composted or uncomposted. Previous work at the Maryland Agricultural Experiment Station (2) had shown that composting greensand with sulphur and organic matter changed a considerable part of the insoluble potassium into a water soluble form.

The author carried out his experiments with barley in glazed pots, each pot held 2800 gm. of sandy loam containing only 0.82 % potassium. To the control pots ammonium sulphate and monocalcic phosphate only were added. The other pots received an equal amount of potassium, in the form of sulphate and pure unmixed greensand, or else a mixture of greensand, sulphur and manure, or greensand compost containing organic matter and sulphur.

Some experiments were made at the same time in the absence or presence of calcium carbonate. Each treatment was in duplicate.

The results obtained show that under favourable conditions, on a soil low in potassium, an application of greensand alone increases the yield of barley. On the same soil, in the absence of calcium carbonate the addition of the mixture greensand + sulphur + manure, and the application of compost greatly injured the crops, whereas in the presence of calcium carbonate excellent results were given.

The author also found that when the compost was applied, large quantities of free acids were liberated in the soil; observations made to determine the water soluble acidity of the compost also indicated the presence of large amounts of soluble iron and aluminium salts. It is to these salts that the author attributes the reduction in yield, produced by the mixture and

(1) See R. March 1921, No. 257. (Ed.)

(2) *Journ. Assoc. of Offic. Agr. Chemists*, IV, 375, 1921. (Ed.)



compost when there is not sufficient lime to convert them into a form that is not injurious to plant life. This is in agreement with the work of other investigators.

To sum up : the author has proved by his experiments that the potassium contained in a greensand-sulphur-manure compost (in the presence of sufficient lime) has practically the same availability as an equivalent amount supplied in the form of potassium sulphate. L. M.

1149 - **The Nitrogen Industry in Germany.** — I MURAOUR, H. (Chef de service des experts chimistes à la Commission militaire interalliée de Contrôle en Allemagne), *L'azote en Allemagne avant, pendant et après la Guerre*, in *Chimie et Industrie*, Vol VIII, No 1, pp 169-175, figs 5 Paris, July 1922 — II MATIGNON, C, *L'Industrie des matières azotées en Allemagne*, *ibidem*, pp 176-184 (1)

I. — The total amount of nitrogenous substances used in Germany before the War was over 240 000 tons ; of these, 200 000 tons were employed for agricultural purposes, which (taking the cultivated area as 35 million hectares), means at the rate of 6 kg. of nitrogen per hectare. This includes only mineral nitrogen, not the nitrogen supplied by organic fertilisers.

As regards nitrates, Germany was entirely dependent on importation before the War. She imported annually from Chile 800 000 tons of saltpetre containing on an average 15 % of nitrogen, that is to say, 120 000 tons of nitrogen, while she obtained from Norway 2 400 to 10 000 tons of synthetic nitrate. On the other hand, the gas industry annually produced 550 000 tons of ammonium sulphate which is equivalent to 110 000 tons of nitrogen. The cyanamide output is difficult to estimate ; it appears that the maximum production was 40 000 tons with 8 000 tons of nitrogen. Finally, by the HABER-BOSCH process, 2 017 tons of synthetic ammonia were made, which represents 1661 tons of nitrogen.

The total nitrogen consumption during the War has been reckoned at 940 000 tons, of which 514 000 tons were applied to military uses, and 426 000 tons employed for agricultural purposes. Thus less than 50 % was used for agriculture than in times of peace, and the crops were considerably reduced. When the war began, Germany possessed the following nitrogen reserves : 6 000 tons under the form of Chile saltpetre, 20 000 tons under the form of Norwegian saltpetre and of cyanamide, and 20 000 tons under the form of ammonium sulphate. In March 1915, these reserves were exhausted but 5 000 tons, taken chiefly from Antwerp, supplied the explosives factories until May 15, the date when the great factories of synthetic nitric acid belonging to the B. A. S. F. at Oppau and Merseburg were in full work.

During the War, Germany imported 8000 tons of nitrogen from Norway ; the coke and gas industries supplied 400 000 tons, whereas in pre-War times, their annual output was only 60 000 tons ; the cyanamide factories produced 168 071 tons, and the synthetic ammonium factories 240 436 tons. At first, the factories of synthetic ammonia were only able to supply a very dilute acid which had to be converted into nitrate before a concen-

(1) See R. Oct. 1922, No. 102<sup>B</sup>. (*Ed*)

trated acid could be obtained. From these nitrates and the nitrate reserves 182 200 tons of nitrogen were obtained under the form of nitric acid. Subsequently, by directly concentrating the dilute nitric-acid, 35 860 tons of nitrogen were obtained.

Since the War, owing to the fall of the mark, Germany has tried to dispense with imported food stuffs and forages, which before the War had reached the value of 3 million marks, trusting to intensive agricultural production to provide the necessary supply. By the Treaty of Versailles, she lost 5 million hectares of arable land, but the reclaiming of new land will soon bring up the cultivated area to the pre-War figure, viz. 35 million hectares. The nitrogen consumption has already exceeded the 200 000 tons used annually during the period preceding the War, and will soon rise to 500 000 tons. The demand now exceeds the supply which has decreased owing to the Oppau disaster and the shutting down of the Knapsack and Walshut factories. A vigorous and successful campaign has been started to induce farmers to use more nitrogenous fertilisers.

As a result of all these changes, the amount of Chile nitrate imported at present is almost negligible, hardly reaching 31 000 tons. The gas and coke industries now supply 110 000 tons of nitrogen as they did before the War; the cyanamide factories could furnish 500 000 tons, representing 100 000 tons of nitrogen. The nitrogen output of the B. A. S. I<sup>2</sup> will be 300 000 tons, which at 30 marks the kg., represents the value of 9 thousand million marks. The amount of nitric acid made by the electric-arc process is the same as before the War, viz., 1272 tons annually.

Factories making nitric acid by ammonium synthesis can produce 111 456 tons of nitrogen, while the nitrogen output of those which obtain it by the concentration of the dilute acid may be 1338 tons.

Before the War, Chile was the country that produced most nitrogen, 392 000 tons; Germany followed with 122 000 tons, after which came England, 88 000 tons; the United States 35 000 tons; France, 16 500 tons, Austria-Hungary 10 500 tons; Belgium 9 800 tons, and Norway 9 600 tons.

At the present time, Germany ranks first with 500 000 tons of nitrogen, which is nearly the total pre-War output of the seven great nitrogen-producing countries. This must not however be regarded as her maximum production, for schemes are under consideration for the construction of other large factories for the manufacture of cyanamide at Pisteritz, and the utilisation of the waterfalls in Bavaria.

II. — Even before the War, Germany was the country that consumed the greatest amount of nitrogen, 218 250 tons. Next followed the United States, 146 000 tons; France 68 000 tons; England 43 000 tons, and Belgium 35 000 tons.

During the last 20 years, Germany has succeeded in increasing by 60 % the returns from her land which although inferior to that of France is much more highly productive. Germany uses for every hectare of land fit for cultivation 8 kg. of nitrogen, France uses 3, England 6.25 and Belgium 17.04.

In the German agricultural programme it is estimated that the annual

consumption of nitrogen this year will reach 500 000 tons. Over a thousand million marks have been expended by Germany in building new factories, but without them in 1921 alone she would have been obliged to import 230 000 tons of nitrate from Chile, which means an outlay of 400 million gold-marks, or 27 thousand millions of paper-marks.

The seven societies engaged in the development of the HABER-BOSCH process, which form the Chemical Industry Consortium, possess a total capital of 1762 millions, to which must be added compulsory obligations amounting to 153 millions. Before the end of 1922, their annual output will be 300 000 tons of nitrogen.

In addition to the old fertilisers, the "Badische" has put on the market several new compounds: ammonium hydrochlorate, ammonium nitrosulphate, ammonium potassic nitrate.

Germany is not satisfied with having been freed from the necessity of importing nitrate but also intends soon to export it, and to enter into competition with Chile on all the markets. Further, she has acquired the means of producing in future hitherto undreamt of quantities of explosives, an amount eight times larger than France could ever manufacture.

A. de B.

1150 - **The Transformation of Ammonia into Urea.** — MATIGNON, C., and FRÉSAQUIS, M. in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. XIV, No. 7 pp. 435-157. Paris, February 1922.

The authors give a report of their studies on the transformation of ammonium carbonate into urea, a process by which in 4 hours 1 % of ammonia was obtained at 130° C, 6 % at 135° C, and 41 % at 145° C. As the reaction is a dehydration process, an attempt to accelerate it was made by the use of catalysts that proved most effective at low temperatures, but were useless at 150° C. The urea thus obtained is very pure and melts at 133° C. It can be separated from the carbonate and other salts present by evaporation in a water-bath, the operation is quantitative.

The results of the authors' studies have enabled them to devise a systematic method for the industrial manufacture of urea, a highly concentrated nitrogenous fertiliser.

A de B.

1151 - **The Decomposition of Ammonium Nitrate by Heat.** — SAUNDERS, H. L., in *Journal of the Chemical Society*, Vols. CXXI and CXXII, No. 714, pp. 698-711. London, April 1922.

This experiment was undertaken with the object of obtaining further information regarding the manner in which ammonium nitrate decomposes when heated. The three points the author proposed to elucidate were: the nature of the decomposition of pure ammonium nitrate at moderate temperatures — the modifications in this decomposition in the presence of small quantities of the impurities commonly occurring in commercial nitrogen — the nature of the explosive decomposition.

The first part of these experiments was directed to the decomposition of specially purified ammonium nitrate dried at 100° C.

A very ingenious apparatus was used by the author which enabled him

to follow accurately the decomposition of ammonium nitrate at different temperatures and to collect the gaseous and liquid products of the process. He found that pure dry ammonium nitrate decomposes only slowly at 200° C. The nitrate first melts at 169° C, then separates into nitric acid and ammonia; it then begins to evolve a gas containing 98 % of nitrous oxide. Free nitrogen, nitrogen peroxide, and nitric oxide are always present. The amount of free nitrogen is nearly 2 % up to 260° C and considerably more at higher temperatures. The average amount of nitrogen peroxide and nitric oxide between 220° C and 260° C was 0.001 % of each.

The liquid products of the reaction contained nitric and nitrous acids.

In another series of experiments, the author studied the influence exercised upon the decomposition of commercial ammonium nitrate, heated to a moderate temperature, by the impurities usually present in this nitrate. The commonest of these impurities are the chlorides of ammonium and sodium, the sulphates of ammonium and sodium nitrate.

In order to study the modifying influences of these substances, pure nitrate and mixtures of each of the salts (specially purified by recrystallisation) were made. Various proportions of these salts were introduced, but the amount never exceeded the percentage found in the commercial product.

In the first place, a series of mixtures were made containing quantities of ammonium or sodium chloride ranging from 0.1 to 2 %. It is difficult to state definitely the temperature at which decomposition takes place; the process is always accompanied at the beginning with a remarkable rise in the temperature. When any mixture is raised to a particular temperature, there is first a passive period varying in length from a few minutes to one hour and a half. How long it lasts depends upon the amount of impurities present, on the temperature, and possibly on the presence of free nitric acid (VELEY, *Chemical News*, 1883, XII, 299). Then a new reaction sets in, and chlorine is evolved and is always present in the gas formed. The composition of the gas produced at the beginning of the decomposition of mixtures of nitrate and chlorides is very different from that of the gas evolved in the normal decomposition of pure ammonium nitrate, for in some cases, the nitrous oxide falls 50 %, while the percentage of nitrogen increases. During the first decomposition period, there is a rise in the temperature of the mixture (20°-80° C), till it has attained a maximum, after which it again falls. The composition of the gas remains constant during the first period for any particular mixture, but as soon as the temperature begins to fall (most of the chloride having decomposed) it gradually approximates to that of the gas evolved at the same temperature during the decomposition of pure nitrate.

Nitric acid is always present, as well as hydrochloric acid, in the water condensed during the decomposition. The action of the chlorides of ammonium and sodium is very similar, but that of ammonium chloride is more marked.

Ammonium sulphate added to the nitrate in the proportions of 1 and 2 % does not produce any special modifications in the decomposition pro-

cess. The gas evolved sometimes however contains a trace of ammonia. A 1 % mixture of sodium sulphate does not influence the decomposition reaction between 220° C and 250° C.

Mixtures with 1 and 2 % of sodium nitrate are without characteristic action.

In a third series of experiments, the author studied the explosive decomposition of ammonium nitrate. A suitable apparatus was selected and tested for the maintenance of a vacuum. The decomposition products were carefully collected and analysed.

It was found that the decomposition by explosion of ammonium nitrate — even at the lowest temperature at which an explosion will occur — is very different from normal decomposition. The amount of nitrous oxide is greatly diminished, and the gas contains nitrogen peroxide, nitric oxide and nitrogen in the approximate ratio 2 : 4 : 5.

The explosion is accompanied by a yellow flame not unlike that of ammonia burning in oxygen.

The results of the author's three sets of experiments may be summarised as follows : pure ammonium nitrate decomposes into nitrous oxide and water to the extent of 98 % between 210° C and 260° C. At some point near 300° C other oxides of nitrogen are evolved, the action proceeding explosively. At the moment of the explosion, the pure nitrate decomposes in a totally different manner, giving nitrogen peroxide, nitric oxide and nitrogen in the ratio 2 : 4 : 5.

Among the products of normal decomposition, nitrogen is always present, in the proportion of about 2 % up to 260° C ; immediately after explosion, the percentage of nitrogen is 46.

As regards the ordinary impurities occurring in ammonium nitrate, the experiments showed that small quantities of sodium sulphate and sodium nitrate do not influence normal decomposition.

On the other hand, small quantities of the chlorides have a remarkable effect. Their action is of a catalytic character and the decomposition process is modified by even 0.01 % of chloride of sodium, or of ammonium.

In the presence of chlorides, there is always chlorine in the gases evolved, the amount depending on the quantity of the chloride and on the temperature. There may be from 30 to 50 % of nitrogen in these gases.

The liquid products of the reaction always contain hydrochloric acid as well as nitric acid.

L. M.

1152 - **Borax (1) in Fertilisers and its Effect on Potato Growth and Yield.** — BROWN, B.F. (Biochemist, Office of Soil-Fertility Investigations, Bureau of Plant Industry, U. S. Department of Agriculture), in *U. S. Department of Agriculture, Bulletin No. 998*, figs. 10, bibliography of 9 works. Washington, D. C., July 1922.

Injury to field crops through the use of fertilisers containing borax was first observed by CONNER, in Indiana, in 1917. Many serious cases of borax injury were reported in 1919, when ample proof of the poisonous

(1) See *R. Jan.* 1919, No. 25. (Ed.)

action of this compound was given. In 1920, a series of well-controlled field tests were conducted on four different types of soil bearing crops of potatoes, maize, peas and cotton respectively.

The author gives an account of the results obtained in Maine on loam; the borax was applied at the rate of 1 to 400 pounds per acre and there were 12 experiment plots. The fertilisers containing borax were applied differently in the three sections: in section 1, they were applied in the furrow 6 days before planting; in section 2, they were applied in the furrow at the time of planting; in section 3, they were sown broadcast and well raked into the soil before planting.

After one month, the number of plants in the control plots was 343; these plots had received 1 ton fertiliser per acre but no borax. The plot that had received 10 lb. of borax per acre had 284 plants. The 20 lb. application showed 205 plants; the 50 lb. application 116; the 100 lb. application 38; the 200 lb. 18 and the 400 lb. application only 12 plants. At the end of the second month, the author inspected the sections and found great differences in them. The section which had been treated in the usual manner by applying the fertiliser in the furrow immediately before planting was the most seriously affected, while that in which the fertiliser-borax mixture was introduced into the furrow some time before planting had suffered least. As the quantity of borax increased the toxic effects progressively increased also. In section 2 the injury was apparently produced with 3 or 4 lb. per acre and certainly with 5 lb., the injury with 10 lb., or more, was very noticeable. During the investigational survey in Maine in 1919, the amount of anhydrous borax found in commercial fertilisers ranged from 0.73 to 2.3%. In view of the fact that 2000 lb. represents the usual quantity of fertiliser applied per acre, it is clear that the amount of borax applied varied from 14.6 to 46 lb. per acre. The type of field injury shown in 1919 was similar to that found in the 20, 30 and 50 lb. applications in the borax experiment.

Some of the injurious effects noted in both seasons were as follows: failure of seed to germinate, dying back of underground shoots, bleaching of foliage, or in less serious cases, marginal yellowing of leaflets, reduction in yield. Yield when 50 lb. of borax were applied per acre, was decreased 55% in the second section and 40% in the first and third sections.

A. de B.

1153 - **Chill's Sulphur Supply.** — HOFFICER, H. G. in *Engineering and Mining Journal Press*, Vol CXIII, No 23, pp 995 1000, figs 8 New York, June 1, 1922.

The sulphur deposits of Chili (1) are little known, as the working of these vast beds has been hindered by their altitude and the lack of proper transport facilities. Under good management these mines on the Pacific Coast could compete with the sulphur mines of Texas, as they are of great value owing to the great extent of the beds.

(1) See R. Mar. 1920, No. 303. (Ed)

The statistics of the sulphur industry are as follows :

Year	Production	Exports	Imports	Consumption
t.	t.	t.	t.	t.
1909. . . . .	4 507	193	none	4 700
1910. . . . .	3 822	1 400	"	5 224
1911. . . . .	4 457	4 013	"	8 464
1912. . . . .	4 431	4 451	"	8 552
1913. . . . .	6 647	1 961	"	8 608
1914. . . . .	10 008	526	"	10 534
1915. . . . .	9 769	711	"	10 450
1916. . . . .	14 879	1 080	"	15 959
1917. . . . .	15 942	47	2 555	15 434
1918. . . . .	19 557	none	6 406	13 151

The exportation statistics are given below :

Country	1917		1918	
	t.	value in dollars	t.	value in dollars
Argentina . . . .	1 976	106 720	3 025	241 500
Bolivia . . . . .	41	2 224	51	7 670
Brazil . . . . .	1 227	66 276	2 573	157 300
Uruguay . . . . .	248	13 371	260	23 000
Totals	3 492	288 591	6 211	425 470

The sulphur deposits are all of volcanic origin and are situated at an altitude of 4000 to 6000 metres ; the beds are often 7 to 10 m. in thickness, 95 % of which is sulphur. The working and refining methods are still very primitive and the climatic conditions render working extremely difficult.

The reserves of the sulphur mines are estimated approximately at 5 530 000 t. with an average sulphur content of 60 %. After the gradual, but inevitable exhaustion of the sulphur deposits of Sicily and Japan, there will be only two large sources of this mineral, so far as is known at present, these being the sulphur mines of Mexico and of the Chilean Andes. The exploitation on a large scale of these mines is merely a matter of time.

A. de B.

1154 - **Accidental Flora imported in Wool and the Question of its Acclimatization in Germany** (1). — SCHENCKRENAUM, R., in *Mitteilungen der deutschen Landwirtschaftsgesellschaft*, Year XXXVII, No. 38, pp. 572-573. Berlin, Sept. 23, 1922.

The accidental flora of Döhren (near Hanover), where there is a large establishment for washing wool, has been several times the object of re-

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(1) Two papers on this subject have been published by the *Hannoversche Land und Forstwirtschaftliche Zeitung*, the first (No. 1, p. 16, Jan. 6, 1922) by the writer, written on the invitation, addressed to him, as a specialist in adventitious plants of the Hanover Chamber of Agriculture ; the second (No. 18, p. 282, May 6, 1922) by M. L. WITTMACK. (*Author's note*).

search and study since 1889. It has been ascertained that the accidental species, which have certainly been introduced in foreign wool, number several hundreds, and every year fresh kinds are observed. The question arises as to which of these species are really acclimatized in the country: it may be said that none have been able to survive for long. Thus, according to Prof. ASCHERSON, *Xanthium spinosum*, a native of South America and now spread all over America, in the Mediterranean countries, Central Europe, Western Asia, South Africa and Australia, have been considered as acclimatized at Döhren; but the writer has pointed out the contrary. During the war the importation of foreign wool was suspended and *Xanthium* disappeared almost completely, to reappear when importation was renewed. It is beyond all doubt that the climate of their new home does not suit these plants and that the insects for cross-fertilizing them are not found there. A few fructify well but do not produce seed capable of germinating. That in spite of this certain species such as *X. spinosum*, *Medicago arabica* and *M. hispida* Gaertn. (= *M. denticulata* Willd.) appear every year in very large quantities must be attributed to the importation in the wool of fresh seed capable of germinating.

Some species of *Medicago* have been observed at Döhren since 1889:—*M. hispida* with the varieties *macracantha*, *confinis* and *apiculata*; *M. arabica*, *M. laciniata* from southern countries in the Mediterranean basin, *M. ciliaris*, native of Mediterranean countries, and *M. minima*.

HEINTZE (*Hann. Land und Forstw. Zeitung*, No. 9, March 3, 1922), has drawn attention to the fact that fruits of *M. denticulata* and of *M. arabica* were found, in 1921, in the wool of several German flocks. But the writer is in agreement with M. WITTMACK on the subject and does not think that there is any fear that these species will be propagated in Germany; the same is true for the varieties of *M. hispida*, for *M. laciniata* and *M. ciliaris*. Regarding *M. minima*, the writer was doubtful in 1912 whether it was able to acclimatize itself, and in fact it has not done so up to the present: it grows only in places which it reaches with the refuse from wool washing, along the railway lines or in the fields where this refuse is used as manure. German breeders have nothing to fear from *M. minima*.

The seeds separated from the wool by washing cannot be successfully sown; their germinative power is very limited; if sheep were sent to graze in pastures sown with these seeds the fruits would attach themselves to the wool and would decrease its value. The writer thinks that the few seeds of *Medicago* found by the wool washing establishment at Döhren in German wool are seeds of exotic species mixed with seeds of inferior quality.

F. D.

1155 - **Study on the Pollen of Fruit Trees.** — CASELLA, D. (*Cattedra di Arboricoltura della R. Scuola Sup. di Agricoltura in Portici*), pp. 24, 4 pl., bibliography of 46 publications. Cosenza, 1922.

In fruit trees imperfect setting of the flowers is due to numerous causes. The writer has undertaken its study, selecting among anemophilous trees the vine and the mulberry and among entomophilous trees the Rosaceæ such as the apple, pear, peach, apricot, almond and plum.



The writer refers to and confirms certain opinions already maintained and adds some personal observations. Firstly he examines the influence of meteorological conditions. A light wind helps pollinization because it transports the pollen of anemophilous plants without scattering. Moreover, by favouring evaporation, it accelerates dehiscence ; finally by shaking the flowers it facilitates the opening of the anther. On the other hand a strong wind scatters the pollen and blows away the insects which assist in pollinization ; it may also break off the flowers and break the branches. Hail has a similar injurious effect. Rain washes away the pollen and makes it burst and germinate prematurely in the anthers ; it causes browning and necrosis of the stigma ; makes transport of the pollen by wind impossible ; washes away the sugary excretions which attract insects, keeps the insects away and prevents them from feeding on the flowers. In the vine during rain, the hood adheres to the stigma and obstructs the anther ; in the Rosaceæ the stamens adhere to the style ; if the stamens are longer than the style, the stigma remains immersed in the water and comes off ; if, later, the water evaporates, the stamens regain their normal position and the anthers dehisce, but meanwhile the germinative power of the grains of pollen which have burst or germinated has diminished. Mist is just as injurious as rain ; its moisture causes partial bursting and premature germination of the pollen and necrosis of the stigma ; pollinization is specially hindered by a thick mist, which deposits a film of water and sometimes small drops. Light and solar heat accelerate all vital functions and consequently pollinization ; moreover they have an indirect action inasmuch as they cause the secretion of nectar and the production of colours and scents which attract insects ; they also stimulate the insects themselves. A high temperature accelerates the germination, the bursting of the pollen grains and the elongation of the pollen tubes. On the other hand, low temperatures retard the dehiscence of the anthers, hinder the germination of the pollen and prolong the duration of the elongation of the pollen tube.

The writer has made numerous observations on pollen and ascertained that not only does the pollen vary in different species but also in certain cases in different varieties and that, in certain varieties of fruit trees, the pollen from the same anther has various forms and dimensions and a different percentage of grains which contain no protoplasmic substance.

The writer undertook numerous tests on the germination of pollen. With this object he tried to use little drops of liquid taken from the stigma of the almond and difficult to collect, as well as the juice of the plum, pure water, moist air, etc. He found that the best was a solution of saccharose in the proportion of 10 % (apple), 15 % (pear), 20 % (almond). He often found abnormal teratologic forms of which he gives a description. The pollen grains of the vine always emit a bubble which persists at the insertion of the pollen tube and keeps it inflated.

The writer has studied germinative power in various conditions. It remained constant for each variety of fruit tree. Pollen from diseased plants was relatively more sterile. The influence of temperature was greater : the optimum temperature was 15° C for the almond, 20° C for the vine.

Fungicidal and insecticidal preparations were almost all decidedly injurious. The writer also tested the effect of these preparations on the setting of vine-flowers: he painted them on the stigmas with a brush. All the preparations were injurious. Sulphur, to which some persons attribute a beneficial action on setting, was also injurious, and it is probable that the beneficial action attributed to the sulphur is due to the dissemination of the pollen helped by the movement of the air and of the cluster at the time of applying the sulphur. Water proved injurious; it intensified the harmful effects of the fungicides and insecticides on the germinative power. The use of such substances should be regulated so as to obtain the advantages which are desired from them, without injury to production. L. V.

1156 - **Characteristic Proteins in Maize.** — SHOWALTER, M F, and CARR, R H (Division of Agriculture Chemistry of Purdue University) in *The Journal of the American Chemical Society*, Vol XLIV, No 9, pp 2019-2023 Easton, Pa, Sept 1922

The writer gives an account of some experiments undertaken on the subject of the content in various proteins and in mono—and diamino—acids of maize. Comparing the species of maize with a high nitrogen content with those with a low content, they found, in the former, a much greater quantity of proteins, in the form of zein and globulin, which were formed at the expense of the amides, as well as albumen and glutelin. Most of the globulin is found in the embryo which, in species with high nitrogen content, forms 15 % of the grain, and in "horse tooth" maize 11 %. Zein is the protein which varies most in quantity, from 50.28 % in the former to 31.85 % in the other species. The protein of maize roasted over the fire for food (pop-corn) contains 57.24 %. Apparently the total nitrogen content determines the proportion of the different proteins.

The diamino-acids, in the species with high nitrogen content, show a percentage of total nitrogen double that of the other species. A. de B.

1157 - **The Part played by Respiration in the Decrease of Carbo-hydrates in Leaves during the Autumn Colour Change.** — COMBES, R, and KOHLER, D, in *Comptes rendus des séances de l'Académie des Sciences*, Vol 175, No 9, pp 406-409 Paris, Aug 28 1922

SACHS holds the view that while leaves are turning yellow in autumn numerous useful substances migrate to the permanent organs of the plant. Hence at the time of their fall leaves are reduced to a skeleton of worthless matter. WEHNER showed the weakness of this hypothesis and pointed out that the centesimal decrease of some substances contained in the leaves could be attributed to washing by rain. TUCKER and TOLLENS recognised that this actually took place for mineral matter, and MICHEL-DURAND found the same to be the case for hydrocarbonates.

The hydrocarbonate content may also decrease under the action of respiration, which continues in the leaves until the death of the tissues, while the chlorophyllian function disappears gradually and consequently is no longer able to make good the losses.

The writers have proved that this supposition is justified by practical experiments on the leaves of *Fagus sylvatica* and *Aesculus Hippocastanum*

plucked when they began to turn yellow, and on the leaves of *Ampelopsis hederacea* when beginning to turn red.

The leaves were placed under an earthenware bell with the ends of their petioles immersed in water. This closed medium was traversed by a current of air from which carbonic acid gas had been removed; the carbonic acid gas emitted by the leaves was fixed in a solution of barytes. At the end of 144 hours the total amount of carbonic acid gas liberated was respectively 41 mg., 33.1 mg., and 58 mg. per gm. of leaves; this would correspond to 27.8 mg., 22.4 mg. and 39.4 mg. of carbohydrates in  $C_6H_{12}O_6$ : there is therefore a perceptible consumption of carbohydrates, due to respiration, in leaves ready to fall. This consumption increases according as the chlorophyll capable of restoring the loss disappears; it reaches a maximum, after which it decreases owing to the gradual death of the tissues.

Several causes bring about the decrease of weight in the leaves when changing colour before falling; so far as carbohydrates are concerned, these experiments show that, besides migration towards the stem, and washing caused by rain, there is the further factor of consumption due to respiration.

L. V.

1158 - **Non-Symbiotic Germination of Orchid Seeds.** — KNUDSON, L., in *Botanical Gazette*, Vol. LXXIII, No 1, pp 1-25 Chicago, Jan 1922

The writer confirms absolutely the results obtained by L. BERNARD on the non-symbiotic germination of orchid seeds (*Laelia*, *Cattleya* etc.). In slightly concentrated liquids, these seeds germinate only when the symbiotic fungus is present, on the other hand in sufficiently concentrated media, sterilized seeds grow also in a non-symbiotic manner. The writer could not bring the sterilized seeds to germinate in dilute nutritive solutions, such as those of PFEIFFER, but in the same media, to which glucose or fructose had been added, the proportion of germinated seeds was greater when the solution was most concentrated. Fructose is more favourable to germination of the seeds than glucose, which generally caused the development of small chlorotic plants. Much starch is accumulated in the young plants. The addition of extracts of potato and beet or of yeast, to the sugary media, was favourable to germination and the same is true for the addition of various micro-organisms, such as *Bacillus radicumicola* or an Actinomycete. The writer thinks that the symbiotic fungus exerts an action similar to that of sugars, inasmuch as it converts starch into sugar or digests other organic matter; he rejects the hypothesis of BERNARD according to which the fungus causes germination by increasing the concentration of the intracellular fluid.

L. V.

1159 - **Variation in the Manganese Content of Leaves according to their Age** (1). — BERTREND, G., and ROSENBLATT, M., in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, 1st Half-year 1922, Vol CLXXIV, No 7, pp 491-913 Paris, Feb 13, 1922.

The writers carefully examined the variations in the manganese content of leaves according to their age. They determined it in leaves taken

(1) See R. Nov. 1921, No. 1097, May-June 1922, No. 549. (Ed.)

simultaneously from a series of plants from the youngest to the oldest. They then repeated this determination for various different species.

Comparing the results obtained with the green and dry matter in the leaves, the plants examined are divided into 4 groups :—

a) That in which the proportion of manganese is greater at the beginning of the growth of the leaf ; it then decreases slowly until growth is complete, when it again increases slightly, *e. g.* beet ;

b) that in which the proportion decreases, as in *a*), but the final increase is rapid and may be so considerable that the old leaves contain more manganese than the young, *e. g.* holly-hock, cytissus, box, yew ;

c) that in which the proportion increases rapidly at first, so that it is greater in leaves which are still young, and then decreases until it falls below that of the leaves of the previous groups, *e. g.* spindle-tree and elder, or nearly approximates to it, *e. g.* lilac, seringa, and privet ;

d) that in which the proportion constantly increases, *e. g.* clematis and Judas tree.

This classification is not absolute as certain plants come under one group or another according as the manganese is considered proportionally to the green or the dry matter.

Analyses of the ash give similar results to those of the leaves ; but the variations are not always parallel in the two cases, apparently because the phenomena of absorption and migration are not quantitatively equal for all mineral substances.

The manganese content has therefore, in a varied degree, a maximum at first, a decrease and a final increase ; it remains to be determined to what extent this variation is in relationship with the biological functions of the plant.

A. de B.

1160 - **The Rôle of Chemistry in the Improvement of Plants.** - G. DE VILMORIN, in *Chimie et Industrie*, Vol 7, No 5 pp 864-869 Paris, May 1927

The writer refers to the chemical methods used in the study of hereditary factors and for the selection of individuals possessing the desired characters and made use of in the Verrières laboratory. He deals with the following plants :— Sugar-beet, mangold, Jerusalem-artichoke, chicory, wheat, potato and plants containing alkaloids.

*Sugar-beet.* — The writer describes the method of cold aqueous digestion, the principles of which were laid down by LOUIS DE VILMORIN as early as 1850 and practised by him in his laboratory at Verrières. With new and improved apparatus it is possible to make 1000 analyses per day. With this method beets containing invert sugar which are undesirable in sugar refineries can be eliminated.

It is only after careful verification on several generations that the seed is multiplied.

*Mangolds.* — These are analysed quantitatively by the preceding method as soon as they are pulled at the time when they contain a minimum of invert sugar ; then the dry matter, which in a given variety is approximately proportional to the total sugar content, is determined.

*Jerusalem-artichoke*. — Here the inulin is determined ; for this it is transformed into reducing sugars with a dilute solution of sulpho-salicylic acid.

*Chicory*. — The dry matter especially is analysed, since chicory is mainly used for torrefaction. Tests are made to discover the inulin content, for it is possible that this plant may in future be used for the extraction of levulose.

*Wheat*. — The bread-making value is mainly considered : the following are determined :— 1) the dry gluten content ; 2) the hydration capacity of the gluten, by means of the formula

$$\frac{\text{moist gluten}}{\text{dry gluten}} \times 100.$$

*Potato*. — The fecula is determined by transforming it into soluble starch with picric acid ; it is then determined by the saccharometer.

*Plants containing alkaloids*. — The use of the colorimeter is fully indicated, but very noticeable reactions in the case of pure salts are not so clear in mixtures. It is quite evident that the analysis must be made for each plant so as to eliminate those that are defective, but as the plants have to be replanted, methods which require a small amount of material only should be used.

P. C.

1161 — **Development of mutilated Seeds of Maize.** BROWN, I. B. (Agronomist, Corn Investigations, Office of Cereal Investigations, in United States Department of Agriculture, *Bulletin*, No. 1011, pp. 1-11, 3 pl. bibliography of 9 publications. Washington, D. C., Feb. 23, 1922)

SEEDS

After recalling the previous experiments of SACHS, VAN TIEGHEM, BLOCISZEWSKI, WOJNY, STINGL, DELASSUS, DUBARD and URBAIN, URBAIN, ANDRONESCU, the writer gives an account of numerous experiments which he carried out on seeds of maize. In one series of these experiments, the embryo was left intact : the seed was decorticated, or else the endosperm was reduced by cutting the seed across near the wider end, richer in starch ; or the embryo itself was completely extracted ; the seeds were thus more or less deprived of reserve material. The experiments were made in the open field at four Experimental Stations and lasted 3 years. The results were uniform : the development of the plants was difficult and late, but they were not dwarfed ; the number of ears was not less than that in the control plots ; the seeds deprived of their spermoderm produced even a greater number of ears, but these were lighter ; on the whole, the yield of grain was less ; the loss was estimated at 5-7 hl. per ha. The decorticated seeds gave the smallest yield, not that their vitality was impaired but because they were more easily affected by surrounding conditions. The least difference was noticed in the seeds which had their starch content reduced by cutting one end off : in some cases there was no difference between plants from such seeds and the control plants.

In another series of experiments, the embryo was cut : the seed being cut through longitudinally so as to divide it into two approximately equal

parts, each containing a portion of the radicle, tigella, gemmula, cotyledon and endosperm ; or else the seed was cut through transversely so as to separate the two ends, the smaller end containing the radicle, tigella, part of the cotyledon and of the gemmula and a small portion of the endosperm. These experiments were generally made *in vitro*, but several were also made in the open field. A great many of the mutilated seeds developed ; the entire embryo is not therefore indispensable for germination and development of seeds. A number of embryos which were cut longitudinally produced relatively normal plants ; in one lot 45 plants were obtained from 38 seeds and in another 55 plants from 33 seeds. The portions of seeds which contained the radicle and from which the gemmula had not been removed produced complete plants with the organs which had been cut through ; where the gemmula had been removed the plant did not reproduce. On the other hand plants grown from upper portions of seed containing part of the gemmula were unable to thrive. Weak plants were generally produced from portions of the embryo. The yield per plant was less than that of the control plant, but the total yield was greater in the case of plants grown from seeds cut through longitudinally ; the number of these plants was greater than that of the plants in the control plots.

Some other experiments were made by removing the embryo and then replacing it *in situ*.

I. V.

#### STARCH CROPS

1162 - Influence of the Weight of the Potato Set on the Crop. — SALAMAN, R. N., in *The Journal of Agricultural Science*, Vol. XII, 2<sup>nd</sup> Part, pp. 182-196, 4 figs. London, April 1922.

Experiments carried out at Barley (Herts, England) with potatoes of the Barley Bounty variety grown on well-tilled vegetable mould, without farmyard manure but which had been manured with superphosphate + sulphate of ammonia + kainit. The results may be summed up as follows : — The total crop is directly proportional to the weight of the sets. The use, as sets, of tubers weighing less than 30 gm. gave a large return and a good proportion of marketable tubers (that is to say not too small), but such sets do not give the greatest yield. If the total weight of the sets, the proportion of good tubers and the total crop, are considered, the best sets are those of tubers weighing about 60 gm. each. Portions of tubers consisting of secondary tubers (that is to say grown on a larger tuber) about 60 gm. in weight gave much more abundant crops than any other kind of set ; slightly smaller crops were obtained by using as sets whole tubers bearing secondary tubers ; both also gave equally a large proportion of marketable tubers. There is an inverse relation between the size of the sets and the percentage of large tubers in the crop. A large production of secondary tubers and a large proportion of heavy tubers in the crop may be connected with want of maturity of the sets. There is no relation between the quantity of secondary tubers among the sets and the quantity of secondary tubers in the crop raised from such sets.

F. D.

1163 - **The Supposed Degeneration of the Potato.** — DUCOMET and RIVIÈRE, in *Bulletin de la Société Nationale d'Acclimatation*, Year 69, No. 8, pp. 143-144. Paris, Aug. 1922.

As his conclusion from a long study of "leaf curl" of the potato, M. DUCOMET (Professor at the School of Grignon) declares himself opposed to the application, in all circumstances, of the universally common practice of changing the seed. When the environment is favourable it would be better to select on the spot.

On the subject of the supposed degeneration of the potato Ch. RIVIÈRE shares M. DUCOMET's opinion. For over 25 years he has grown the same varieties in the Jura without having had to renew the seed. Up to the present he has only noticed in his crops pathological deterioration varying with the season and no physiological deterioration.

However, by changing climate, especially by moving south, the potato becomes less productive and to get satisfactory yields the seed must be changed<sup>1</sup>. But in this case there does not appear to be true degeneration in the exact sense of the word, as when this potato is planted further north, it immediately regains its normal character.

A current practical example may be mentioned. The potato grown in Northern Africa as an early crop, even in a state of complete maturity, produces bad seed potatoes from the second year and can no longer be used after the third year; in consequence, seed potatoes have to be obtained each year from the North of France. The same is the case in the Canary Islands where seed potatoes are imported from England. F. D.

1164 - **Cultivation of Lucern in Sub-Tropical Semi-Arid Regions.** — UPHOF, J. C. TH. in *Der Tropenpflanzer*, Year 21, No. 11-12, pp. 169-173. Berlin, Nov.-Dec. 1921.

Lucern is suitable for semi-arid regions; for this reason it is largely grown in the Southern States of North America and covers many thousand of hectares in California, Arizona and New Mexico. By means of irrigation six crops a year may be obtained; without irrigation, the growth of lucern is impossible, as indeed is the case for most other crops. Lucern tolerates alkaline soils provided the content of salts in solution does not greatly exceed 0.6 %; it should however be noted that the young plants are much more sensitive than the full grown plants and that they are killed by 0.05 — 0.1 % of alkali; plenty of irrigation should therefore be given in alkaline soils immediately after sowing, so as to carry much of the salts into the lower layers, whence they will rise by capillarity, but the young plants will then be less sensitive. The lucern field should be level so that it may be uniformly irrigated and cleared of weeds. In semi-arid soils sowing should take place from September to May; if made later than May, irrigation is necessary for germination; but the very young lucern plants cannot break through the crust which is formed after irrigation, and it is therefore necessary to repeat irrigation again every 2 or 3 days, which would be impossible or impracticable.

When sown in autumn lucern requires but very little attention during the winter; if the winter rains are not sufficiently frequent, irrigation 2 or 3 times a month is sufficient, taking care not to make the soil too moist, which would prevent the roots from growing down. During the hot season it is

customary in Arizona to irrigate twice a week and to harrow between the rows to keep the soil in a better condition of moisture. The first mowing takes place during the latter half of March, the last in November, sometimes early in December. Generally lucern is made into hay for cattle.

The writer carried out numerous investigations on lucerne at the Experimental Stations of the Arizona University, at Yuma, Phoenix and Tucson where the rainfall is only 60, 190 and 340 mm. respectively and where humidity varies very much in the hot season, being 80-90 % from 5 to 6 o'clock in the morning and 25-35 % about 2 p.m.

In 1910 lucern seed was obtained from foreign countries and from Arizona farms and experiments have continued since that time. It should be noted that the seeds of commerce are all impure and often very heterogeneous. To get pure seed the writer enveloped the flowers to protect them against insects, especially *Bruscofagus funebris* the larvae of which prevent the development of seed. Self-fertilisation did not give such good results as artificial pollinisation, which is easily done by rolling the small flowers between the thumb and the forefinger; if several successive pollinisations have to be carried out the fingers should be washed with alcohol at 40° after each pollination. Pollinisation should be repeated every other day during the flowering period. The selected plants can also be propagated by cuttings; these are made about April by cutting cleanly below a node and the cuttings are then planted in a nursery of coarse sand; they are kept shaded and if it is sufficiently moist and warm they take root readily; when they are well rooted the young plants are transplanted temporarily on to soil where the roots grow and the plants get accustomed to sunshine; shortly after, they are planted in the open field.

The writer has compared numerous varieties of lucern with reference to several factors:— height and width of the plants, weight directly after mowing (about the flowering season) and after drying, respective weight of leaves and branches, transpiration (the moisture given off was absorbed by means of phosphoric acid) expressed absolutely and proportionally to the transpiration surface which was carefully measured with a planimeter, etc.

The maximum yield obtained during several years of researches was given by the villous Peruvian lucern 39 a (21.25 kg. per ha.); closely followed by an Italian variety (20.90 kg.) and Peruvian 30° C (20.80 kg.). Peruvian lucern also gave the best results in other experimental fields, thus proving that it is most suitable for the climate. Not only does this variety give a higher yield but it begins to grow at a temperature of 10° C, while most of the other varieties require a temperature of at least 13° C, but Peruvian lucern is not suitable for cold climates. In Arizona it is still but little grown (1200 ha. out of 74 000), its cultivation is however increasing.

L. V.

1165 - Experiments with Mangolds. — LINDHARD, P., in *Tidsskrift for Plantavl*, Vol. XXVIII, No 2, pp 276-285 Copenhagen, 1922.

The writer describes experiments made with the object of comparing the yield and the dry matter content of mangold roots raised from seed of



the same variety grown in Denmark and in Germany and England. The results shows that in Denmark the seed produced large roots of good quality, while in the other countries it produced small badly formed roots ; apart from that no other influence of the different cultivations on the crop was noticed. The following are the results of 27 experiments made at Tystofte, Lyngby and Askov :—

Crop in qs per ha of seed sown :—

In Denmark	In other countries	Difference $\pm$	Average error
700 13	689 54	— 10 59	$\pm$ 1 80
Percentage of dry matter in the roots: —			
13 13	13 31	+ 0 18	$\pm$ 0 034

Experiments on the crop of mangolds grown from seed obtained from selected roots of average size, compared with that obtained from small unselected roots gave the following results :—

Crop in qs per ha., seed from :—

Small unselected roots	Selected roots of average size	Difference
603	624	= 21
Percentage of dry matter in the roots :—		
12 91 00	12 75 00	+ 0 16
A. de B.		

1166 - **Brazilian textile Plants.** — FEHLINGER, H., in *Der Tropenpflanzer*, Year 24, Nos 11-12, pp 173-176 Berlin, Nov-Dec 1921

TEXTILE  
PLANTS, ETC.

Brazilian statistics of external trade have shown that Brazil imports enormous quantities of textile material, especially jute and hemp, although its vast plains are suitable for the growth of these two plants. Moreover numerous native plants furnish good textile fibres. Up to the present scarcely any attention has been paid to these crops as planters have been concerned with the growth of coffee and rubber ; but at this time rubber has to meet strong competition from the Far East and all markets are over supplied with coffee ; in these circumstances it is possible that textile plants may be pushed

A number of native textile plants are already largely used by the Indians and Creoles, some of which deserve attention. At present Brazil exports only a small quantity of fibre obtained from the bark of two palms : — *Leopoldina piassaba* Wall. and *Attalea funifera* Mart., known under the name of " piassava ". The first of these palms grows in a region difficult of access, the valley of the Rio Negro, a northern affluent of the Amazon ; the fibre of this palm is more highly valued and the whole output is sent to the Manaos market.

This palm is very abundant in the south of the State of Bahia and in the north of Espirito Santo, but it abounds also in other places and forms regular forests, even on very poor sandy soils. The bark is removed twice a year ; the yield is 2.5 kg.-5 kg. per tree. The fibres are about 25 m.-5 m. long ; the longest are used for sail canvas and the thickest are cut and made into brooms, brushes, sandals, hats.

"Piteira" *Foureroya gigantea* Vent. is one of the Amaryllidaceæ characterised by leaves 3-4 m. long growing directly from the root, which furnish a fibre used by the natives for making shoes; well prepared, this fibre might rival Manilla hemp. The Dutch had grown this plant with success and they tried to introduce it also into their Asiatic Colonies; it is still grown at the present time on some farms. It is suited to all soils, even poor ones. Plants of 4-8 years old give the best fibre and some forty leaves a year can be taken from each plant when they begin to bend and before they turn yellow.

Three of the Malvaceæ give an excellent fibre for bags. The most suitable is "aramina" *Urena Lobata* L., which is found in nearly all tropical countries; it is from 1.5 m. to 2 m. high and is cut between the two flowerings of February and July; the fibre, which forms about a quarter of its weight can be extracted by steeping in boiling water; as the fibres extend into the branches, they have a length of 2 to 3 m. The "papoula of São Francisco" grows wild in Central Brazil, but it has been brought under cultivation; its fibre is better than that of Manilla jute. Several species of the genus *Sida* are very common in Brazil; they are small plants not exceeding 50 cm. in height but contain an excellent fibre; they grow and ripen in 4 months and multiply with extraordinary rapidity; once introduced they are difficult to extirpate; well considered cultivation might increase the height and improve the quality.

The "gravata" should also be mentioned, which include two of the Bromeliaceæ, *Ananas sagenaria* Schult. and *Bromelia Karwinskii* L., delicate in appearance, but more vigorous than the "piteira", which looks much more robust; its leaves which are sometimes as long as 2 m. give a fine, glossy fibre with great powers of resistance, its cultivation requires but little attention, except as regards adequate irrigation; the outer skin is strong and makes the extraction of the fibre difficult; but this defect could be eliminated by selection.

L. V.

#### OIL BEARING PLANTS

1167 — **Observations on the Flower of the Olive Tree.** — I CAMPBELL, C., Studi sull'olivo in terra di Bari, *Pubblicazioni della Stazione agraria sperimentale in Bari*, No 1, pp 54, 1 full page coloured plate Bari, Dec 1921 — II OCCHIALINI, O, Osservazioni sul fiore dell'olivo nelle varietà della Riviera ligure, *Oleum, Rivista mensile dell'olivicoltura, dell'Olivicoltura e del Commercio oleario pubblicata a cura del R. Oleificio sperimentale di Porto Maurizio*, Vol I, No 5, pp 93-95. Porto Maurizio, Aug 1922

I. — The writer has made a study of the flowers of the olive since 1900. In this statement he describes the observations he made in "Terra di Bari" which enabled him to confirm the fact that among olive trees which fructify normally there are a few, either isolated trees or groups, which do not flower, or which, while flowering fairly profusely, give little or no fruit. In these cases most of the flowers have a reduced pistil. This reduction of the pistil may vary between a state of perfect development and a rudimentary condition. On the same tree, the proportion of "imperfect" flowers varies from one branch to another and in different years. If branches of a fruitful olive tree are grafted on a tree which bears no fruit, the latter becomes fruitful and vice versa. Pruning, manuring, spraying

with sulphate of copper etc. have no influence on this "imperfection" of the flowers. Imperfection cannot therefore be attributed to causes of a pathological kind; the fact that unfruitful trees grow alongside normal trees confirms this view. THEOPHRASTUS, 300 years B. C., had already noted that the phenomenon was peculiar to certain places, that is to say was inherent in the trees themselves, and independent of pathological conditions.

"The presence of staminiferous flowers on plants produced from seed and bearing hermaphrodite flowers only is not only found in the olive but also in the peach, almond and several other spontaneous plants, and also in the vine" (1).

II. — Observations on olives of the eastern "Riviera Ligure" and, specially in the trees in the grounds of the "R. Scuola di Agricoltura di S. Ilario Ligure" which belong to the varieties generally grown in Liguria, namely:— "Lavagnina" or "Taggiasca" — "Pignola" — "Rossese" — "Ogliastra" — "Croa". Some trees of the "Ascolana" variety were also observed.

The "Lavagnina" variety is considered best on account of its very abundant flowering and its fleshy fruit which is rich in oil of good quality, giving a yield which may exceed 25 %.

In this variety flowers with reduced pistils or without pistils are very rare and in a few trees only has their number been as many as 8 %. The "Pignola" variety is much liked on account of its high productivity and the excellent quality of its oil, the yield of which is 20 %; flowers with reduced pistils or without any are fairly numerous:— 38 to 49 %.

The fruit of the "Rossese" variety is larger than that of the preceding varieties; the yield of oil is poor (14 %), but the quality is excellent; it flowers abundantly but its productivity is unsatisfactory. Staminiferous flowers are very numerous, 74 to 89 %.

Trees of the "Ascolana" variety observed by the writer have always given a poor crop of olives; they had the maximum of unproductive flowers, 95 %.

All the trees under observation were healthy, vigorous and still young.

Manuring was on a basis of green manure, beans, farmyard and other organic manures; pruning, and digging the soil had not the slightest influence on the formation of the flower.

It is chiefly on trees with a high percentage of staminiferous flowers that a few hermaphrodite flowers are found on the topmost part of the crown of the tree (2). F. D.

(1) See R. Feb. 1919, No 174; R. Feb 1921, No 134. (Ed.)

(2) The observations of Professors CAMPBELL and OCCHIALINI confirm Prof PIROTTA'S parallel observations. On the other hand, according to Prof. PETRI (Studies on the diseases of the olive tree, Rome, 1914) unproductiveness of olive trees is a consequence of the conditions of nutrition of the tree and at the same time an indirect consequence of all the internal and external influence which may modify these conditions. He therefore thinks that rational cultivation of olives is very useful for avoiding or considerably reducing the tendency of the trees to produce staminiferous flowers.

See R. July and Aug. 1920, No. 725. (Ed.)

1168 - **Experimental Stations for Oleaginous Plants in French African Colonies.** — BAILLAUD, F., in *Bulletin des Matières grasses de l'Institut Colonial de Marseille*, Nos. 1-2, pp. 1-56. Marseilles, 1922

Groundnuts and oil palms stand first among colonial oleaginous plants, and are the subject of the two reports of the writer which were presented to the Fats Section of the Colonial High Council for the establishment of Stations in Africa specially charged with the study of these plants. It was intended that these Stations should be founded with the funds derived from the liquidation of the Oil Consortium founded during the war.

The import trade of fats in France in 1913 amounted to a total of 465 687 t. equivalent weight in oil: the export trade of fats from French Colonies in 1913 was 143 425 t., of which 99 551 t. were consigned to France.

*Groundnut.* — The Station intended for the study of this plant is at M' Bambe, in Senegal. Its programme includes two stages: — selection of the seed, and the propagation of selected seed. For the former it will be necessary to study all existing types of groundnut and to search for pure lines which will lead to the preservation of a few pure forms from which selection will start. Adaptation to various soils, methods of cultivation, the influence of chemical manures and farmyard manure, the diseases and insects which attack the crop, must all be studied. For this purpose 100 ha. of land will be required, half of sandy soil and the other half of sandy-clay soil. When these studies have led to definite results and the best types have been found, production of the selected seed commercially will be taken up and about 500 ha. will be devoted to the purpose. The estimates for carrying out this programme in five years are fixed at 3 500 000 fr. The writer however criticises the programme of DENIS, Inspector General of Agriculture for French West Africa, for in it the question is mainly the cultivation of large areas with the most modern mechanical means and the construction of numerous buildings, while scientific questions, which are most important and should take precedence, are not sufficiently prominent.

*Oil-Palm.* — The establishment of two Stations for this Palm, one on the Ivory Coast and the other at Dahomey, is proposed. The first should serve for the direct working of plantations under the supervision of technical officers, for the introduction of machinery for dealing with the drupes, for forest exploration with the object of the creation of plantations under European management; the second would deal with the industrial aspect of the treatment of the fruit, with the propagation of selected types, with the rational working of plantations, etc. In short it is rather a question of a wide programme of industrial working than of a programme of research.

For the establishment of the Station at Mé (Ivory Coast), a total expenditure, from 1922 to 1928, of 4 480 400 fr. is estimated; from 1929 the revenue should exceed the outgoings with a profit increasing up to 1935 and constant as from 1936. For the Station at Pobe (Dahomey), the estimate of expenditure for establishment up to 1928 is 3 014 000 fr., while the profits are estimated similarly as for the Mé Station.

After criticising in detail the proposed arrangements, the writer concludes his report by pointing out that it is unwise to assume that the French Colonies will easily be able to supply France with all the crude fats which may be required, since the increase in colonial production is proportional to the increase in population and to the development of means of transport. The proposed schemes are too costly, as the total amount exceeds 11 million francs, and moreover they are not principally concerned with scientific research, but rather with the creation of large plantations, the success of which is largely dependent on the solution of questions which have yet to be studied. The Stations ought to be organised on different lines and should be mainly experimental. For the study and solution of the problems involved and for securing the large funds which will be required — the 5 million francs from the former Oil Consortium being insufficient — the forces of the Colonial Government and of the manufacturers and merchants interested in the matter should be combined in a single association. So powerful an association would be able to make its experimental work cover not only one or two Colonies, but the whole French Colonial Empire.

F. C.

1169 — **Less known vegetable Oils and Fats of Japan.** — SPANN, A, in *Der Tropenpflanzen*, Year 21, Nos. 11-12 pp. 161-169 Berlin, Nov-Dec 1921.

Together with the oils of well known seeds, other oils or rather other vegetable fats more or less local and derived from the various plants, which the writer describes, are used in Japan.

*Aleurites cordata* Muell. — A tree called "Abura-Kiri" oleaginous "Kiri" in Japan because it closely resembles *Paulownia imperialis* which is commonly known there as "Kiri". It is grown in sub-tropical countries and its fruit yields a siccative oil called "dokuye no abura" which thickens and dries with extraordinary rapidity and in this respect it appears to be unrivalled. It is kept in tightly closed receptacles and its chief use is for joinery and especially for filling up surface cracks in furniture before lacquering. It is also used for caulking boats and generally for preserving wood. Owing to these uses it is commonly called "oil for wood". The oil is also used for lubricating machinery, waterproofing paper and even as a purgative; in the crude condition it is used also for fuel. It is chiefly valued because it is quite colourless, inodorous and tasteless. The cold process is used in the manufacture and the refuse, which is abundant and has been analysed by TESCA, would make a good manure.

*Perilla ocymoides*. — This Labiate plant is grown in the northern part of Japan; but almost all the seed is imported into Japan from China and specially from Korea, where it grows wild and is also partly cultivated; in Japan, it bears the name of "Yeogoma" or "Jingomashi". The small round seeds contain about 46 % of fats and much protein (KBLNER's analysis); they are edible, and the extracted oil is used as a condiment, for burning, for waterproofing paper for lanterns, umbrellas, etc. and for mixing with lacquer. The leaves of *Perilla* contain an aromatic oil which keeps off mosquitoes. The writer gives some information regarding the cultivation of this plant.

*Camelia japonica*. — This plant grows wild, but is also cultivated as an ornamental plant; its large seeds, which weigh up to 3 gm. each, are 42 % husk; the kernel contains up to 70 % of oil; the seeds are dried in the sun, and then pressed whole or husked, generally by heat process. Commercial *Camelia* oil, called "tsubaki no abura", is light yellow and fragrant when of good quality; it is chiefly used for toilet purposes and also for lubricating delicate machinery, watches, arms, and in some places it is used for food purposes. It is often adulterated with other oils. Japan exports this oil to neighbouring countries.

*Camelia sasanqua* Thumb. — This *camelia*, unlike others, flowers in winter; the seeds, which are smaller and contain less oil than those of the preceding species, furnish an otherwise similar product. In addition to the seeds of these two *Camelias* the seeds of tea, which contain about 40 % of oil, are largely used in China, but not in Japan, for the extraction of oil.

*Cinnamomum camphora* Nees. — The Japanese name is "Kusu no ki". This tree produces small seeds which contain about 42.5 % of fats, extracted by heat process and transformed at ordinary temperature into a crystalline mass with a fragrant scent like that of cocoa-butter. It must not be confounded with oil of camphor, a secondary product of the distillation of the wood of the same tree.

*Machilus Thumbergi* Sieb. and Zun. — In Japan this tree bears the name of "Isukuru" or dog's camphor. It is one of the Lauraceæ and the seeds, which are larger than those previously mentioned, yield 65 % of fats. Other varieties of the Lauraceæ are also used, but not *Laurus nobilis*, the seeds of which are rich in a fat which is extracted in certain countries.

*Torreya nucifera* Sieb. and Zun. — This is one of the wild Tanaceæ called by the Japanese "Kaya", the fruit furnishes a siccative oil, used in cabinet-work and also for waterproofing paper and as food.

*Cephalotaxus drupacea* Sieb. and Zucc. — This is also one of the Tanaceæ, the oil being used for similar purposes, it is however not edible.

I, V.

**RUBBER, GUM  
AND  
RESIN PLANTS**

1170 — **Pressure in the Roots of *Hevea brasiliensis***. — BOBILIOFF, W., in *Archiv für de Rubbercultuur*, Year VI, No 3, pp 113-124. Buitenzorg, March 1922.

The writer has studied the pressure in the roots of *Hevea brasiliensis*, and has arrived at the following conclusions:—

1) The pressure in the roots is both positive and negative. In comparison with other tropical trees which have been examined, *Hevea* shows the lowest pressure. Trees in full leaf have the highest pressure namely 1442 atmospheres.

2) In *Hevea* the pressure in the roots shows scarcely any variation in the various periods of growth of the leaves. During the winter period, a slight tendency towards negative pressure was observed.

3) Changes in weather have no influence on the pressure developed in the roots of *Hevea*, so that during the rainy season no higher pressure was observed than during the dry season.

4) Different hours of the day have hardly any material influence on the pressure, though slight fluctuations have been noted during the night and a slight increase was observed during the early hours of the morning.

5) The insensibility of the pressure in the roots to changes in external conditions in *Hevea*, is explained to a certain extent by the fact that these changes have only a slight influence on the activity of the roots of the tree.

6) It is incorrect to speak of the direct influence of the pressure in the roots of *Hevea* on its production by driving the latex out of the laticiferous vessels or by causing the latex to ascend from the laticiferous vessels of the root to the cut surface.

7) The low pressure in the roots of *Hevea* is only indirectly important, because of its small influence on the life of the tree.

8) There is more intense activity in the roots of young *Hevea* plants than in those of the full grown tree, as may be ascertained by incision. The pressures recorded are relatively low (the highest was 1416 atmospheres), but they remain constant for several days, when they have reached the maximum F. C.

1171 - **Camphor in Tonkin** (1). - CRÉVOST, CH and DE FENIS, P, in *Bulletin Économique de l'Indochine*, Year XXIV, No 149, pp 367-427, 22 figs Hanoi Haiphong, July-Aug 1921.

This paper gives information regarding experiments recently made by the various French Colonies for the improvement of their agricultural, industrial and commercial resources, the writer having been originally instructed in 1904 by the Tonkin Government to ascertain the importance of the growth of camphor yielding plants in the Province of Bắc-Giang. After a short historical account of the more recent works published on the subject of camphor from 1903 to 1920 the writers made a botanical study of camphor trees. These are classified under 3 principal species growing wild in Indo-China.

1) *Cinnamomum Camphora* Nées and Eberm. — *Laurus Camphora* L. — *Camphora officinarum*, grows in Yên-thê (Province of Bắc-Giang) and in the Provinces of N Annam. It is called "Râhuong" in Annamite, "Mây Kao chung", "Mây Khao Khinh", "May Khao hom" in Thai, "Long nao" in Chinese.

2) *Cinnamomum Balausae* H. Lec., the wood of which has the smell of fennel. This tree has been of no importance as a producer of camphor, but it may be of interest on account of its essential oil.

3) *Cinnamomum Simondii* H. Lec. which is very probably the camphor tree worked in Kouang-si. The species *C. parthenoxylon* Meissn., or false Camphor (in Annamite "Vu huong") and *C. ilicoides* A. Chevalier (in Annamite "Gu huong") should doubtless be considered as synonyms of *C. Simondii* H. Lec. and *C. balausae* H. Lec. To these species should be added *C. cecidodaphne* var. *caniflora*.

(1) See R. Sept 1921, No 915. (Ed.)

Besides these camphor yielding trees other plants which furnish similar products may be mentioned, namely:— *Blumea balsamifera* D. C. (1) (in Annamite "Dai bi" and "Cô bang phien") which produces a levorotary borneol which can by oxidation give a levorotary camphor, identical with the camphor of Japan, except as regards rotary power. Another of the Compositæ, resembling an *Inula*, was found by the writers in the Yen-thé forest and some Chinese merchants have stated that a special essence called "Luc-nhi-Linh" in Chinese, is extracted from it.

The writers deal in a separate chapter with the chemical composition of camphor, its derivatives and the subject of synthetic camphor which is very important in its relation to natural camphor. Regarding synthetic camphor, it is important to note that Prof. SOMMELET of the Paris faculty of chemistry has stated that the product cannot be considered as a medicinal drug because most of the artificial camphors have no action on polarised light, while natural camphor is strongly dextrorotary, but that it can be used for the manufacture of celluloid provided that it is freed from chlorine which remains as an impurity consequent on the use of hydrochlorate of pinene as raw material.

The distillation of camphor is very important and the yield is largely proportional to the kind of apparatus used. Thus with the method used in Japan and Formosa and described by DAVIDSON a yield of 2.16 % by weight is obtained. On the other hand with the apparatus of Prof. MORIYO of the College of Agriculture at the University of Tokio an average yield of 4.22 % in addition to a yield of oil of 1 to 1.50 % of the wood used, was obtained. According to this authority a smaller yield of camphor and a larger yield of oil is obtained in summer and the contrary in winter.

	Weight distilled	Crude Camphor	Camphor oil
	kg.	kg	kg.
In Summer . . . . .	120	2 35	1 60
In Winter . . . . .	120	3	0 63

During the last few years distillation of the leaves of the camphor tree, which previously was entirely neglected, has become very important and the writers, after having examined and compared the results obtained by men who have studied and inquired into the question, made experiments on samples from Tonkin. On a basis of the smell of bruised leaves, which varies with different trees, they fixed three classes of leaves each of which gave a different yield of camphor. Leaves of the first class, which smelt fairly strongly of camphor when bruised, produced from 0.48 to 0.56 %; those of the second class, which gave out a faint smell of camphor when bruised, yielded from 0.25 to 0.30 %; those of the third class, which smelt like



pippins when bruised, gave no trace of camphor. The most favourable area for the growth of the camphor tree stretches from the 20th to the 25th degree of north latitude. In Formosa trees in the mountains give a higher yield than those in the plains; those growing in open places and much exposed to the sun give a higher yield than those which grow under shade in damp valleys.

Heavy, well drained, deeply tilled clay soils suit camphor trees best. The Camphor tree requires plenty of potash and lime; in Ceylon 196 lbs. of lime and 87 lbs. of potash (in the form of the ashes of refuse from the distillation of the leaves) are used per acre.

The germination of the seeds is hastened by immersion in a vessel of tepid water at  $25^{\circ}$ : this enables the good seeds, which are heavy and sink to the bottom, to be distinguished. The fruit is pulped by means of special iron sieves. This operation facilitates the germination of the seed which takes place 3 months later. When the young plants reach a height of 30-45 cm. they are finally transplanted.

The camphor tree is also propagated by cuttings, by layering and by grafting. In Tonkin the best season for transplanting is from February to March.

The spacing between the young plants varies; it may be:—

- 1) 2.40 m. in squares giving about 700 plants per hectare;
- 2) 3 m. in squares; about 450 plants per ha.;
- 3) plants 1.80 m. apart in rows 4.50 m. apart; about 500 plants per ha.

In Tonkin, on good soil, when 3 years old the plants are 2 m. to 2.50 m. high and when 5 or 6 years old they reach a height of 4.50 m.

The leaves are gathered by means of special apparatus.

According to the spacing in the plantations the yield obtained is:—

- 1) 70 kg. of camphor per ha. in the first type of plantation;
- 2) 45 kg. per ha. in the second; and
- 3) 50 kg. per ha. in the third.

In the course of journeys made in 1920, the writers investigated the camphor resources of various districts in Tonkin (Lang-son, Bắc-giang, Thai-nguyên and Quang-si) and discovered some trees several centuries old which they describe in their paper.

According to E. GILDEMEISTER and Fr. HOFFMANN, the industrial uses of camphor and its derivatives are the following:—

Spirit of Camphor, free from solid camphor, is used as a fuel oil by the poorer classes in Japan. It is also used as a solvent of resin in the manufacture of lacquer. The lamp-black resulting from its combustion is used in the manufacture of Indian-ink.

In Europe, safrol is extracted from essence of camphor and the residual spirit of this preparation has many uses as light or heavy oil of camphor.

Camphor forms part of the composition of celluloid. It is also largely used in pharmacy.

The writers conclude their paper with a reference to the fact that,

by the local Government Decree of Dec. 20, 1920, they procured the prohibition of the felling of camphor trees of all ages in Tonkin and they hope that the competent authorities will create a camphor Service whose duties would include :—

1) The listing and registration, village by village, of the best seed producing camphor trees ;

2) The collection from these selected trees of seed in sufficient quantity to allow the cultivation of these trees to be spread over as large an area as possible.

3) The making generally known by means of active propaganda, the various processes of extracting camphor from the leaves.

4) The management of a certain number of experimental plantations in different districts in order to ascertain the most suitable place for planting on a large scale.

5) The observation and following up of the work that is being done in Formosa in the matter of improving camphor planting and the processes of manufacturing camphor.

F. C.

1172 - **Copal.** — J. P. and F. D., in *Congo, Revue generale de la Colombie Belge*, Year II, Vol II, No. 4, pp. 543-557. Brussels, 1921 ; Year III, Vol I, No 2, pp 208-239, figs. 2. Brussels, 1922.

The exports of copal from the Belgian Congo from 1902, in which year 339 640 kg. were exported, to 1912, when the export amounted to 3 755 801 kg., have increased more than ten-fold. Owing to the great economic value of the product, which has increased at the present time by 1500 %, the writers undertook the study here reviewed.

The name "copal" is given to a resin secreted by certain trees belonging to the Leguminosæ. Commercially this resin is known by various names :— Brazil "anini or animé resin" ; Bombay, Calcutta or East Indian, Copal ; "Kanri", "cowrie" or "cowdee" copal, Manilla Copal, Accra Copal, which is commonly called "gum animé" in English. This product is collected on the East Coast of Africa, in Zanzibar, Madagascar, Sierra-Leone, Congo, Guinea, Angola, Gold-Coast, Southern Nigeria, Brazil, Australia and New Zealand.

The African commercial varieties are the most valued in the varnish industry ; they include 15 varieties, each of which have several qualities which only a very expert eye can distinguish.

Copal is obtained from living trees as well as found in a fossil state buried in the ground ; for this reason the specific botanical origin of certain copals remains unknown or is very uncertain.

On the East Coast of Africa, at Zanzibar and in Madagascar the commonest species which yield the greater part of the resin are :— *Hymoenea verrucosa* and *Trachylobium verrucosum* ; in West Africa, *Copaifera copallina*, *c. Guibourtiana* and *c. demensei* ; American copal is derived exclusively from *Hymoenea Courbaril* ; the copal of Australia, New Zealand and Manilla is secreted by conifers of the genus *Dammara*.

The resin occurs in 3 forms :—

- 1) green or soft copal ;
- 2) fossil or hard copal ;
- 3) semi-fossil or semi-hard copal.

The first is collected direct from the tree and sold immediately after collection ; the second is found in the ground in more or less irregular voluminous masses, often bituminous ; semi-fossil copal has been buried in the ground for a shorter time and is never completely bituminised. Soft copal becomes milky and opaque in boiling water, while hard copal does not change.

The colour and appearance of copals vary according to the commercial variety.

Copals are divided into 5 categories according to their geographical origin :—

- 1) East African copals ;
- 2) West African copals ;
- 3) New Zealand Kauri copal ;
- 4) Manilla copal ;
- 5) American copals.

#### I. EAST AFRICAN COPALS.

a) *Madagascar copal* derived from *H. verrucosa*, locally called " Tau-rouk Rouchi ", and includes three kinds :— green, fossil and semi-fossil.

b) *Zanzibar copal* found only in a fossil state ; the tree which produced it has disappeared but has been identified by KIRK as being *T. verrucosum* which bears the name " Niti sandarusi " in the country, while the resin is called " Sandarusi ya nitin ". Zanzibar copal is the hardest of all and most in demand.

c) *Mozambique copal* derived from *T. verrucosum*, a species which tends to disappear to such an extent that at present it is hardly ever found except in a fossil state.

d) *Inyambana copal*. — This is a kind of copal which is seen in German markets, and is produced by *Copaifera Gorskiana* Benth. = *Gorskia conjugata* Bolle ; the natives call it " staka " or " inthalaka ".

#### II. WEST AFRICAN COPALS.

a) *Sierra-Leone copal*. — Produced by *C. guibourtiiana*.

b) *Guinea copal*. — Produced by *C. copallina*.

c) *Belgian Congo copals* secreted by 3 species of *Copaifera* :— *C. arnoldiana* de Wild., *C. demusei* Harem, *C. Laurentii* de Wild. The following are the amounts exported during the last ten years :—

Year 1909 . . . . .	t. 826	Year 1915 . . . . .	t. 4 260
» 1910 . . . . .	» 976	» 1916. . . . .	» 8 677
» 1911 . . . . .	» 2 139	» 1917. . . . .	» 6 911
» 1912 . . . . .	» 3 756	» 1918. . . . .	» 3 611
» 1913 . . . . .	» 4 698	» 1919. . . . .	» 6 231
» 1914 . . . . .	» 6 693	» 1920. . . . .	» 13 250

The most valuable commercial kinds in the Antwerp market are:—

- 1) Selected Congo copal gum, white.
- 2) Selected Congo copal gum, slightly yellowish.
- 3) Selected Congo copal gum, amber.
- 4) Selected Congo copal gum, brownish.

Next comes common unselected Congo copal.

In 1915 the price of Congo copal varied between 800 and 1000 fr. per t., in 1920 it reached 5500 fr. per t.; at present the price is falling.

d) *Gabon copal*.

e) *Angola copal*, always of fossil origin.

f) *Gold-Coast copal*, produced by a species of tree which grows in the Ashantee and Ikim forests and is not well known botanically.

g) *Nigerian copal*, produced by *Cyanothyrsus oblongus* = *C. Ogea* = *Daniella oblonga*.

h) *Benguela copal*.

III. NEW-ZEALAND KAURI COPAL. — The tree of origin is *Dammara australis*, a conifer which grows between 34°·5' and 37°·5' south latitude.

In New Caledonia copal is derived from *Dammara ovata*.

IV. MANILLA COPAL. — This is the least valuable commercial copal and is produced by *Dammara orientalis* = *Agathis alba*. It is not obtained from *Vateria indica*, which is an arborescent Dipterocarp.

V. AMERICAN COPALS. — These are almost all produced by *H. Courbaril* one of the Leguminosæ common in Brazil, the Antilles, Venezuela, Mexico and Guiana; it occurs in the green and also in a semi-fossil form.

The best valued quality in copal is hardness.

In decreasing order of hardness come:—

Zanzibar	copal	Angola	copal
Mozambique	"	Benguela	"
Sierra-Leone	"	New-Zealand	"
Belgian Congo	"	Indian	"
Gaboon	"	Brazil	"

Of the characteristics which determine the market value of copals, next in order come transparency, density (in inverse proportion), colour, and resistance to fusion, the minima temperatures of which are as follows:—

Brazil	copal	77°
Kauri	"	110°
Angola	"	125°
East African	"	131°
Semi-fossil Zanzibar	"	139°
Fossil Zanzibar	"	158°

Bags and boxes made of thin planks, giving insufficient protection to the contents and causing the pieces to adhere by pressure should not be used for packing. Copal is chiefly used for making thick varnishes and lacquers, and its other uses are of little importance. Spirit of copal is used to adulterate spirit of turpentine.

P. C.

STIMULANT,  
AROMATIC,  
NARCOTIC  
AND  
MEDICINAL  
PLANTS

1173 - **The Chemistry and Manufacture of Tobacco.** -- CHESLEY, A. S. (Chemist, The American Tobacco Co., New York) in *The Journal of Industrial and Engineering Chemistry*, Vol. XIV, No. 9, pp. 817-819. Washington, D. C., Sept. 1922.

The writer deals with the influence which chemical research has exercised on the manuring and cultivation of the tobacco plant, on the control of its diseases and on the different methods of manufacturing tobacco. The proportion of ammonia, phosphoric acid and potash in the soil has special importance for the growth of tobacco. Want of ammonia checks growth, excess of ammonia produces a strong, dark tobacco with a higher nicotine content.

A manure deficient in potash or containing chlorides produces a tobacco which does not burn well. Lime favours certain diseases. De-budding improves and increases the size of the leaves because of the greater concentration of the available plant food. A few years ago potassium nitrate used to be added to tobacco during manufacture to make it burn better; now the use of suitable manures makes this unnecessary. Often bad burning or bad odour is due to the paper, which may contain impurities, difficult to analyse chemically, but perceptible by the sense of smell. Other improvements were made in the manufacture, specially in the matter of the amount of moisture in the tobacco, which was regulated so as to prevent mould and to obtain products of unvarying composition. During the war chemical science succeeded in replacing varieties imported into the United States by other native varieties which had never previously been grown and gave good results.

A. DE B.

1174 - **Temporary and permanent Shading of Cocoa, Coffee, etc. in the Belgian Congo.** -- KINGS, R., in *Bulletin de l'Association des Planteurs de Cameroun et autres produits coloniaux*, Vol. IX, Nos. 1 and 5, pp. 86-89. Antwerp, 1922.

The question of temporary and permanent shading for cocoa, coffee etc. plantations is very important, and has long engaged the attention of Colonial planters.

Experiments have therefore been made in the Belgian Congo, especially at Maymbé, as the question is of special interest in this region owing to the low altitude, the high temperature during the rainy season, the irregularity and frequent scarcity of the rainfall and the long duration of the dry season.

*Temporary shade.* -- Banana-trees are used for temporary shade; they are quite successful where the soil is very fertile and rainfall is abundant and regular, provided that they are removed in good time. As however removal entails much labour it is not carried out to the great detriment of the plantations. The writer long ago recommended that the banana tree, which has many drawbacks as a shade plant, should be replaced in the Belgian Congo by "Ambrevade" which is superior to all others (*Clitoria cajanifolia*, *Leucaena glauca*, *Indigofera*, *Tephrosia*, *Sesbania ægyptiaca*, *Ricinus communis*, etc.) used for the same purpose.

In the first place "Ambrevade" has the advantage of being a soil improver; it also grows rapidly into a shrub and attains a height of 2 to 3 m.; its leaflets are small and do not hinder the rain and mist from

reaching the cultivated plants, its roots are taproots and it does not require much water; it can be lopped as desired and disappears through exhaustion in two or three years, and finally it yields seeds of high food value. Sowings should be made in pockets, preferably two or three months before the cocoa is planted, or immediately after transplantation; two or three seeds are sown in each pocket and covered with two or three cm. of earth; when they spring up only a single plant is left to grow per pocket. In sowing it is important to understand thoroughly how to arrange the direction of the shade plants which should have reference to the sun, dominant winds, etc. South of the Equator, when two shade plants are used for each cocoa plant, one should be placed to the north-east and the other to the north-west forming, with the cocoa plant, a triangle with sides 50-60 cm. long; when three plants are used, one should be to the north, the second to the east and the third to the west. The orientation will be the reverse in the zone situated to the north of the Equator.

There are two species of "Ambrevade", one, the greater "Ambrevade" (*Cajanus bicolor*), is the better because it has a larger growth and two plants are enough to shade a cocoa plant; the other, the lesser "Ambrevade" (*Cajanus flavus*), requires on the other hand three plants per cocoa plant. During the rainy season the shrubs should be lopped and shortened to 1 m, but exact data are at present lacking to show whether the cut branches should be left on the ground or whether they should be burnt.

*Permanent shade.* — The writer recommends for this purpose in the Congo the selection of trees with the following properties. —

1) articulated petioles and moveable leaflets so as to avoid preventing rain and moisture from reaching the plants below;

2) deciduous leaves, so that the trees may not dry up the soil by continual transpiration; they are less attractive to insects and in case of attack the insect can be destroyed by burning the leaves. It may be objected that trees with these properties would not shade the plantations during part of the dry season, but this objection is unimportant because, during that period, these trees bear numerous dry pods which, as regards shade, act similarly to leaves, and shade during the dry cold season is not so important as during the hot season. *Selection of species of shade trees:* — The writer has tried *Erythrina lithosperma* (Dadop), *Albizia stipulata*, *A. moluccana*, *Leucæna glauca*, *Deguelia macrophylla*, *Cæsalpinia dasyrachis*, *Albizia Lebbek*, *Inga Saman*, etc., but he considers that the best are *A. stipulata* and *L. glauca*; if these trees cannot be obtained, *A. Lebbek* and *I. Saman* can be used.

*Method of planting, spacing, etc.* — Young seedlings must be used, not cuttings which do not stand wind and whose spreading roots would be injurious to the plants requiring shade; it is a good plan to plant a certain number of "ambrevade" at the same time as the permanent shade trees, for the better shading of the cocoa and coffee plants while young. These temporary shade plants should be got rid of at the proper time

The permanent shade trees should be planted every 4 m. alternately with a cocoa or coffee plant; if trees of larger growth are used they should be planted 12 m. apart so as not to give too much shade to the plantation. Moreover, if the shade trees are planted every 4 or 8 m. a certain number would be lopped when they had grown up and the remaining trees would have slender trunks. It has also been suggested, instead of planting ordinary shade trees, to plant *Elaeis* which would be left to grow when the cocoa in the plantation was exhausted after 10 or 12 years, as happens in some places; there would then be a plantation of *Elaeis* in place of cocoa. At high altitudes, as coffee plantations require less shade, the permanent shade trees can be spaced from 10 to 15 m. apart according to the aspect of the ground. F. S.

1175 - **The Cultivation of *Pyrethrum* in Switzerland.** — FAES, H. (Chef de la Station fédérale d'essais viticoles de Lausanne), in *Tiré à part de l'Annuaire agricole de la Suisse* 1921, pamph. of 6 pages, figs. 3 Lausanne

The insecticide powder obtained from *Pyrethrum* (*P. cinerariæfolium*) is very effective against *Cochylis* and is obtained by pounding the dried inflorescence of the plant. It is found in a wild state and cultivated in Montenegro, Dalmatia, Herzegovina and in the Quarnero islands (Is- tria) up to an altitude of about 1000 m.

The powder obtained is specially active if it comes from half-closed or withered flowers. Unfortunately it is difficult to recognise under the microscope whether the powder is that of flowers picked green or withered. The writer undertook the cultivation of the plant in Switzerland having regard to the difficulties of procuring authentic powder of good quality. When collecting the seed it must be remembered that it is situated below the "florets" which look like a floral receptacle.

Sowing may be done either in April-May, or in July-August as soon as the seed is gathered. Spring sowing gives better results than later, since in the plantation, plants are ready for planting out in the autumn of the same year.

Sowing should be done in rows 20 cm. apart. The seed should not be covered but simply pressed into the soil and heaped over with leaves or fresh farmyard manure.

Watering and light weeding are indispensable.

Final planting should be done on well prepared soil without special manuring. Ground with a south aspect and slightly stoney, is suitable. The plant does not tolerate wood ashes. Planting is done in rows 60 cm. apart, the spacing of the plants in the lines being 50 cm. While the plants are taking root water moderately. During growth weeding without watering is required.

After gathering the flowers the peduncles should be cut with a sickle.

*Pyrethrum* does not begin to bear freely until the second year. For gathering the flowers a dry, sunny day should be chosen. The flowers should be dried in the shade and can be gathered by hand or by using a shears.

The writer obtained the following yields:— 1500 plants growing on 450 sq. m. of land produced 30 kg. of dry flowers in the 2nd year; 1 kg. of dry flowers yields 6 kg. of concentrated solution of pyrethrum-soap which diluted to 60 litres is sufficient for treating 450 sq. m. of vines at normal spacing. It should be borne in mind that this solution should only be used on caterpillars of the first generation, for those of the second generation get into the seed as soon as they hatch out. P. S.

1176 - **Acclimatisation in France of *Spartina Townsendi*, a Soil-binding, Forage and Paper yielding Plant.** — CORBIÈRES, and CHEVALIER, in *Bulletin de la Société Nationale d'Acclimatation*, Year 69, No 5, p 147 Paris, Aug 1922

For some time *Spartina Townsendi* (1) one of the Poaceae native to America, which spread rapidly and is useful for fixing loose sands, has been found abundantly at the mouth of the Vire (Manche). This plant when young is excellent forage for cattle, and when full grown serves for the manufacture of pulp for paper. F. D.

1177 - **Study on the Pollen of Fruit Trees.** — See No 1155 of this *Bulletin*

#### HORTICULTURE

1178 - **Influence of Grafting on the Resistance of Aurantiaceae to Cold.** — COUDERC, G., in *La Parfumerie Moderne*, Year 15, No 8, 147-151 Lyons, Aug 1922

The writer, a breeder of the vines which are named after him, has carried out experiments since 1889 on the resistance of Aurantiaceae to cold. They are based on two principles:— 1) Grafting on Citrus (*Citrus triptera* Desf., the Siberian orange); 2) Selection of seedling plants.

The work already done on this subject is reviewed and the resistance of Japanese orange trees (*Citrus japonica* Thunb. and varieties) is noted.

The grafting of Agrumes on *C. triptera* is considered in Algeria to dwarf the grafts, but the writer has been able to ascertain that the tree so produced runs to flower in an extraordinary manner, which is worthy of consideration when growing Agrumes for scent. By selection of seedling plants the writer has been able to get, for all species of Citrus, individuals more than ordinarily resistant to cold. Plants which have stood cold (—9°, —10° C. at Aubenas, where the writer worked) and which did not lose their leaves from frost, are grafted on *C. triptera* and stand cold as well as the Japanese Citrus (—14° C). The writer describes the method of grafting Agrumes on *C. triptera* and the precautions to be taken.

The conclusions which he draws from his experiments are as follows:— This grafting will enable the growth of Agrumes to be extended almost throughout the zone of the olive tree, with the exception of low-lying places and on plains which are subject to hard white frosts: the maritime regions of the West of France, where *Acacia dealbata*, commonly called Mimosa, does not suffer from frost, would be suitable for such cultivation; the

(1) According to the *Index Kewensis*, *Spartina Townsendi* is a synonym of *S. stricta* which is found, in Italy in places inundated by brackish water near Venice, Monfalcone, Aquileja, etc G. ARCANGELI, *La Flora italiana*, Loescher, Turin-Rome, 1894. (Ed.)



grafting of the Seville orange on *C. triptera* will enable a large quantity of flowers for the manufacture of perfume to be obtained without risk from frost; the durability of the grafts may be depended upon.

P. C.

1179 - **Phylloxera-Resistant Vinestock.** — BIOLETTI, F. T., FLOSSFEDER, C. H., and WAY, A. E., in *College of Agriculture, Agricultural Experiment Station, Berkeley, California, Bulletin* 331, pp. 81-139, 11 figs., XII tabl. Berkeley, Cal., Oct. 1921.

VINE GROWING

The resistance of a vine stock to phylloxera not only depends on its behaviour with regard to phylloxera but also on the graft which it bears and on the climate and soil in which it is grown. Each stock under investigation should consequently be experimented with by grafting on to it the best graft and by growing it under various conditions. Work of this kind has been carried out at the California Experimental Station since 1876. Among the publications of the Station, some thirty treat of phylloxera and vines which resist it; of recent publications the more important are *Bulletins* Nos. 127-131-146-148-180-192-187, *Circular* 76 and the *Bulletin* which forms the subject of the present abstract. That *Bulletin* gives the results obtained with 21 resistant vine-stocks, some of them pure American Kinds (*Rupestris* St. George — R. Martin — R. Pischah — *Riparia* Gloire de Montpellier); others hybrids between various American Kinds (*Rip.* × *Rup.* 101-14 — *Rip.* × *Rup.* 3306 — *Rip.* × *Rup.* 3309 — *Riparia* × *Berlandieri* 157-11 — *Rip.* × *Berl.* 420-A — *Riparia* × *Rupestris* × *Cordifolia* 106-8 — *Riparia* × *Rupestris* × *Candicans* 1616 — *Rupestris* × *Candicans* = *Vitis Champini*; others again hybrids between American kinds and *Vitis vinifera* (Aramon × *Rupestris* N° 1, N° 2 and N° 9 — Mourvèdre × *Rupestris* N° 1202 — Chaselas × *Berlandieri* 41-B — Cabernet × *Berlandieri* 333 E. U. — Bourrisquon × *Rupestris* 93-5 — Tokay × *Rupestris* — Lenoir = *Aestivalis* × *Cinerea* × *Vinifera*).

*Stocks recommended for each graft.*

Muscat . . . . .	41-B	420-A	101-14
Corinthe noir . . . . .	41-B	R. Gloire	A × R. n° 1
Corinthe blanc . . . . .	3306	St George	—
Sultana . . . . .	3309	1202	A × R. n° 1
Sultana . . . . .	41-B	A × R. n° 1	420-A
Dattier de Beyrouth . . . . .	A × R n° 9	A × R. n° 1	93-5
Empereur . . . . .	3309	3306	A × R. n° 1
Cornichon . . . . .	R. Martin	St. George	41-B
Tokay . . . . .	41-B	3309	—
Malaga . . . . .	3309	3306	402-A
Alicante Bouschet . . . . .	41-B	420-A	—
Gros Mansec . . . . .	1202	41-B	—
Petit Sirah (Duriff) . . . . .	3306	420-A	41-B
St. Macaire . . . . .	41-B	3309	420-A
Ugrein . . . . .	3309	41-B	1202
Valdepeñas . . . . .	3309	41-B	—
Semillon . . . . .	3309	420-A	3306
Palomino . . . . .	3309	3306	41-B

Most of the results are arranged in tabular form and deal with:—  
 1) qualities of stocks for growth in nurseries; cost of cuttings; facility of grafting; percentage and completeness of rooting; growth in the nursery; 2) quality of stocks for general growth: character of the grafting union; vigour and longevity of the grafted vine; quality and yield of the crop. Other tables give the best stocks for each graft and the best stocks for general use. An abstract from the former is given in the table above: the first column indicates the best stock, the second the second best stocks and the third column the third best stock. F. D.

1180 - **On the Sensitiveness of Grafted Vines to Frost.** — KROEMER, K (Geisenheim), in *Wein und Rebe*, Year 4, No 4, pp 188 194, Mainz, Aug 7, 1922

This is a general review of the question. Grafted vines are said to be less resistant to frost than non-grafted vines. But in France, CASTEL and others have maintained that grafting on a resistant stock increases the resistance of the variety grafted; GAUTIER has gone so far as to admit that by making a series of grafts the resistance conferred keeps on increasing.

Some experiments show the beneficial effect of stocks on the variety grafted.

According to CERCELET, only a delay in the emission and opening of the buds is caused in such cases, so that they do not suffer from late frosts in spring. However, observations contradicting those mentioned above are not lacking, for example those of OBERLIN. Careful investigations were made in Switzerland by FAES and PORCHET who counted the buds killed by a hard frost in April 1913. From these researches it was found that certain grafted vines suffered less than others which were non-grafted; but the former were young and robust, the latter old and exhausted. Vines of the same age grafted or not had the same power of resistance. As it is difficult in the open vineyard to get absolutely comparable conditions, the writers made experiment with a current of cold air at a temperature of  $-3^{\circ}\text{C}$  down to  $-3.5^{\circ}\text{C}$ ; the stocks were *Riparia*  $\times$  *Rupestris* 11 Dufour; *Riparia*  $\times$  *Rupestris* 3309 C and Mourvèdre  $\times$  *Rupestris* 1202 C; the graft was Guetedel de Fontainebleau; the same variety used as a direct producer served as control. The writers took care to make their experiments with vines of the same age and vigour. No appreciable difference was noticed.

FAES has now renewed his experiments on vines at the Lausanne vine growing Station (H. FAES, *Gelées d'avril*, in *Revue de Viticulture*, vol. 56, p. 281, 1922) and has collected them in several tabular statements. From these it appears that differences in resistance to frost should be attributed to age and not to grafting.

L. V.

#### FORESTRY

1181 - **Programme of the Swedish State Institute of Experimental Forestry for the Period 1922-26.** — *Meddelanden från statens Skogsforskningsanstalt*, Vol. XIX, No. 1, pp. 66-70, Stockholm 1922.

The Council of the Swedish Institute of Experimental Forestry has approved the programme for the period 1922-26 which decides that

the investigations commenced in the course of previous years (1) should be more energetically continued and includes in addition the following fresh problems:—

(I) *Problem of forest regeneration.* — Fixing the best time for collecting cones; research on the production of cones by seed-bearers; studies on the growth of oak, beech and alder so as to ascertain the importance of different varieties; experimental growth of the pine of North Sweden in southern soils; growth at different altitudes of seed from various districts taking into account meteorological conditions. Experiments relating to different methods of selection; researches regarding the possibility of developing close thickets of pine; treatment of the soil to assist natural reproduction. Determination of the best time for sowing and planting taking into account meteorological conditions; experimental growth on ground frequently frozen, on sterile soil and on marshy ground.

(II) *Development of forest regions* — Collection of material for the study of the constitution and production of selected forest trees; this study will take into account data on regeneration obtained by various methods of selection. Problem of felling forests, from a physical standpoint.

(III) *Diseases and injuries of trees.* — The conformation of the ground in various types of forest and the problems relating to it

(IV) *Species of forest trees and acclimatisation of exotic trees in Sweden* — Production of Douglas fir and growth of seeds of known origin.

(V) *Research on forest soils* — Frequency and distribution of the brown type of soil with vegetable mould in Central and Southern Sweden. Arrangement of material collected dealing with the soil and with sub-soil water. Effects of frost. The transformation of marshy land into forest, revision of old drainage channels, further improvement of land in various regions and the effect of deforestation on soils. Experiments relating to the biological influence of lower animals on the nature of the soil, new methods of capturing these animals; variation of forms according to the type of the forests, comparison between cultivated and virgin soils. Eventually other investigations will be made as new problems present themselves. Besides these matters, the Institute will make researches into numerous practical operations of forestry. A. DE B.

1182 — **The Distillation of Stumps and felling Refuse of *Pinus ponderosa* (Western Yellow Pine).** — See No 12.1 of this Review

## LIVESTOCK AND BREEDING.

1183 — **"Peste de Cezar" (Encephalomyelitis in the Horse) in the State of Paraná (Brazil).** — URBAIN, M. G. in *Annales d. Médecine vétérinaire*, 67th Year, Nos 8 and 9, pp 365-371. Brussels, Aug-Sept 1922

HYGIENE

In the State of Paraná, goods are transported in carts drawn by horses; the latter are sometimes on the road for whole months and are fed during the journey on maize purchased in the inns along the road. Dur-

(1) See R May 1919, No 606

ing the months of July, August and September, these horses are subject to a disease, locally known as "Peste de Cezar", of which the symptoms are the loss of one eye, followed by that of the other. At the same time, they lose the faculty of controlling their movements and there is a retention of urine, causing irregular and violent movements, coma and death within 48 hours of the outbreak of the disease. An anatomical-pathological examination shows the stomach to be dilated and full of maize in a state of fermentation, the intestine always empty and the nerve centres covered with lesions.

This disease, which the writer calls epizootic encephalomyelitis, is probably due to a fungus resembling *Aspergillus*, which grows during the above-mentioned months on the freshly-harvested barley stored at the inns. The writer thinks this fungus causes the lesions of the nervous system.

He also believes that the possibility of the scarcity of vitamins in the food consumed (maize only) being the cause of the disease, may be excluded. The disease can be prevented by using well-harvested, quite dry and unfermented maize. E. F.

**1184 - Should Milch Cows which react against Tuberculin be Sacrificed? —**

CALMETTE, A. (Sub-Director of the Pasteur Institute at Paris) in *Revue vétérinaire*, Vol. LXXIV, No. 6, pp. 356-362. Toulouse, June 1922.

The Board of Health of the Aisne Department have expressed a tentative desire to make the tuberculinisation of cows kept for the public milk supply compulsory, and to order that all cows which react against it be sent to the slaughter-house. It is clear that if it were proved that there is a large percentage of milch cows reacting against tuberculin in France, the adoption of such measures would be attended with serious consequences, for it would cause a decrease in milk production and an increase in price of milk.

It would be opportune, therefore, to examine some of the facts recently established regarding the part played by bovine tuberculosis in human infection before putting these measures into execution.

It is known that the bacilli of tuberculosis *adapted to the bovine species* have special characteristics which clearly distinguish them from those *adapted to the human species*, that the former are rarely met with in human tuberculosis and that the latter are but very slightly virulent towards cattle. For this and other reasons, it may be affirmed that bovine tuberculosis only plays a very small part in the etiology of human tuberculosis, and that consequently the campaign against it from the point of view of the safeguarding of the public health is of little importance.

It is perfectly natural, on the other hand, that the economic interests of agriculture urge breeders to protect their cattle against bacillary infection, which causes a decrease in milk production and prevents the fattening of the infected animals.

The extent of these losses is considerable; they may be estimated in France, before the war, at 20,000,000 fcs. a year and in 1920, accord-

ing to the statistics of the Veterinary Sanitary Department, about 2,000,000 cattle out of a total of 12,757,720 were tuberculous.

The writer asserts that all those animals which react against tuberculine are not tuberculous or liable to propagate the disease, but that reaction simply indicates the existence of a seat of infection which, in the majority of cases, remains occult or latent, and which, in many animals, is cured when the latter are kept free from infection for a sufficient time. It is inadmissible, therefore, that cows, without any trace of disease having been detected after a clinical examination and whose milk contains no tuberculous bacilli, should be excluded from milk production on the mere pretext that they have reacted against tuberculine. If this happened, it may be estimated that milk production in France would be reduced by a third, thus entailing a proportional increase in price without any appreciable advantage to public health.

The writer concludes with the assertion that from the sanitary point of view the measure proposed by the Board of Health of the Aisne Department appears unacceptable.

E. F.

1185 - **Skin-diseases among Livestock at Portorico.** — RIVERA A. (Inspector Veterinario Auxiliar), in *Gobierno de Puerto Rico, Departamento de Agricultura y Trabajo*, Circular No. 68, pp 1-9 San Juan, P R., April 1922.

Very brief notes on the etiology, symptomatology and therapeutics of the following cutaneous diseases among domestic animals: swine gall, ox tumours, acute eczema of the ox, contagious eczema on the lips of the sheep, sheep gall (*Sarcoptes scabiei*), *Psoroptis communis* gall, tick epizooty (*Ixodes ricinus*), ox nettle rash, swine nettle rash, chronic eczema, sebaceous eczema, diffuse suppurative dermatitis, swine impetigo, phthiriasis, *S. scabiei* gall of the goat and ox, ox hypodermiasis, ox trichophyty and subcutaneous emphysema.

E. F.

1186 - **Sheep-Killing Dogs in the United States.** — COLL, M. W., in *Farmers' Bulletin No 1268* (United States Department of Agriculture), pp. 1-30. Washington, June 1922.

Sheep-farming in the United States has greatly varied in the last 5 years, the number of sheep decreased from 64 millions in 1903 to 26 millions in 1922, while the population has increased to such an extent that the present wool production of the U. S. is only one half of that required. The future welfare of the people therefore requires that the greatest efforts be made to extend sheep-farming. This is rendered easier and more profitable by the fact that grazing and feeds are comparatively cheap and the demand for meat and wool is great. Among the obstacles against sheep-farming which discourage farmers and prevent others from taking up this industry, should be mentioned the losses, sometimes considerable, caused to the flocks by dogs. The dogs which kill sheep generally range in small groups of two or three, but sometimes alone. They pass over a territory of several miles, attacking and destroying the flocks they meet with; and as they carry on these operations at night it is dif-

difficult to find them and still more difficult to take them *in flagrante delicto*. Some dogs kill one or two sheep, others as many as they come across; others again chase them until they die of exhaustion; these sheep are found dead without bites or wounds. Once a dog has killed a sheep it will kill others and will encourage other dogs in the same habit, which habit it is very difficult to cure. Their extermination therefore becomes a necessity.

A good means of protection is to pen the sheep on a grazing-ground surrounded by a wire netting about 2 metres high; but this is dear and can hardly be erected except on a small extent of ground. Better laws regarding the policing of dogs should be made than those which are now in force; the people would help to maintain them and they could be easily and advantageously applied. A very high dog tax could be levied in order to restrict their numbers, and the residue of such tax applied to relieving the losses caused to sheep owners. In some States there is no special legislation in this direction; the right to tax dogs is left to the parish, but this system does not give entire satisfaction. Other States have laws, which do not, however, require that the dogs be identified; others again require that they be identified and a description of the dogs kept in registers; a collar with a metal disk bearing a progressive number, the year and the name of the State, is placed round the dog's neck. In several States the owners are obliged to keep their dogs under control, especially at night; in other parts dogs caught killing or chasing sheep may be killed, and in others again this is allowed when the dog is found out of doors during the night without its owner, or when it is without its collar with the disk, or when it can be proved to have killed sheep. The most recent laws provide for the possible compensation of the farmer for sheep killed or mutilated. In every State the owner of the dog is held legally responsible for any damage caused by the dog, but owing to the difficulty of identifying the owner, the farmer generally is only insufficiently protected. This is also the case in those States where farmers receive compensation out of the dog taxes, which are almost always insufficient.

In a word, the different States must take new, better and, as far as possible, uniform measures to remedy the defects of the existing laws. The writer quotes and examines the laws of the different States and draws attention to those of Michigan, which have given the best results. The writer advises all the States to adopt a law, with possible modifications and adaptations, based on the following essential points:

A tax to be paid on every dog of over four years, which must wear a collar with a disk supplied for the purpose; all dogs must be kept under control during the night and the owner to be fined for any infraction of this law.

The farmers to be compensated.

Dogs without an owner or which are caught mutilating sheep or poultry or found on an enclosure not belonging to their owner, may be killed.

E. F.

1187 - **Experimental Research on an Eruptive Disease of the Goat observed in Greece.** — BLANC, G., MELANIDI, C. and CAMINOPELOS J., in *Annales de l'Institut Pasteur*, Vol. XXXVI, No. 8, pp. 614-618. Paris, Aug. 1922.

An illness which attacks the goat in Greece has been observed, which seems to be caused by its feeding on certain plants, among which the most injurious is considered to be *Hypericum hirsutum*, known in North Africa on account of its phototoxic properties.

In this disease, a thick, black scab forms on the muzzle, near the mouth and nose, from which exudes a serous liquid almost always accompanied by oedema of the lips. Red, ulcerated papulae, covered with a thin pultaceous layer, form in the mouth; and the breath becomes foetid. After 2 or 3 weeks, the scabs fall, the papulae disappear and the disease vanishes. The writers obtained an artificial reproduction of it by using as a virus an emulsion of crushed scabs in a physiological solution, or the product obtained by grating the papulae. E. F.

1188 - **Chemical Composition of the Bodies of Domestic Animals.** — MURRAY, A. J. (University College, Reading), in *The Journal of Agricultural Science*, Vol. XII, 2nd Part, pp. 103-110, 1 diagr. London, April 1922.

ANATOMY  
AND  
PHYSIOLOGY

The chemical composition of the body of livestock is determined when its fat content is known, since the composition of the part which is not formed of fatty matter is practically the same in all these animals and does not depend on the condition (degree of fatness) of the animal and varies very little with its age. The part which is not fat is composed of water, of proteins and of inorganic matter. The percentage of water decreases with age, as has been proved in the case of oxen and pigs and as it is permissible also to conclude in the case of sheep from the data at present available. The ratio of proteins to inorganic matter is the same for sheep and oxen and a little higher for swine; it does not change with age in any of these species, but may be influenced to a certain extent by feeds. Individual variations are greater for swine than for ruminants.

The following are the averages (in round figures) for oxen, taken from LAWES' and GILBERT'S analyses:

*Composition of the bodily constituents of oxen other than those formed of fatty substances.*

Animals during growth . . . . .	Ash	4	Proteins	20	Water	76 %
Adult animals . . . . .	"	6	"	22	"	72 %

Following the results of T. L. HAECKER'S experiments (1) the writer notices that among the non fatty constituents protein forms 79 to 84 % of the dry matter and inorganic matter the rest, i. e. 16 to 21 %. The ratio of proteins (P) to inorganic matter (I) is:

$$P : I = 4.392 \pm 0.215.$$

The average percentage may be calculated by the formulae:

$$P = 0.815 (100 - A) ; I = 0.185 (100 - A).$$

(1) See R. Aug. 1922, No. 850. (Ed.)

To calculate  $A$  (percentage of water) the writer made the graph of the values found by HAECKER and thus obtained.

$$A = 90 m - 0.03624.$$

where  $m$  indicates the weight of the body without the fatty substances.

Applying the same method of calculation to the swine analyses made by C. C. SWANSON (1) the writer finds for these animals the formula

$$P = 0.83 (110 - A) ; I = 0.16 (100 - A).$$

To calculate  $A$  the same formula as for oxen is used.

The writer deduces from LAWES' and GILBERT's analyses that the ratio of proteins to inorganic matters is practically the same for sheep as for oxen ; but to calculate the water, a rather lower coefficient must be used, namely :

$$A = 87 m - 0.03624.$$

By these formulae the average composition of the whole body at any time may be calculated when the live weight of the animal and its percentage in fatty substances are known. F. D.

1189 - **Investigation on Milk "Retention" in the Cow.** — ZEITZSCHMANN, O. in *Le Lait*, 2nd Year, No. 4, pp. 229-237 Lyons, April 1922

After having spoken of the normal secretion and flow of the milk, the writer turns to the "mechanism" of its "retention". From observation he believes that this phenomenon is due to a mechanical obstruction. The actual internal cause of the phenomenon is a rapid and total displacement of that part of the teat which touches the sinus. According to the writer, involuntary excitation of the muscles through the sympathetic system causes the retention of milk. There is a large number of smooth muscular cells in the middle layer of the cow's teat which can contract and thus completely obstruct the teat, driving back the milk which is normally near the lower part of the sinus, so that not another drop of milk can issue, the external passage being completely blocked. F. S.

FEEDS  
AND  
FEEDING

1190 - **Food Value of Oats and Tares as Green Forage Hay or Silage.** — I. WOOD, T. B. and WOODMANN H. E., Digestibility of Oat and Tare Silage, *The Journal of Agricultural Science*, Vol. XI, Part 3, pp. 304-309 London June 1921 — II. WOODMANN, H. E., Comparative Determinations of the Digestibility and Metabolisable Energy of Green Oats and Tares, Oat and Tare Hay, and Oat and Tare Silage *Ibid.* Vol. XII, Part. 2, pp. 144-145, Apr. 1922.

I. *The Digestibility of Oat and Tare Silage.* — Digestibility test made on 2 sheep during 2 periods of 14 days each. During one period they were given a maintenance ration of 500 gm. of meadow hay plus 100 gm. of linseed cake ; to which ration during the second period, 1000 gm. of oat and tare silage were added. The coefficient of the digestibility of the silages was, respectively, for each animal: total dry matter 55 and 55.54 % —

(1) See R. July 1922, No. 751. (Ed.)



crude protein 66.19 and 18.15 % — ether extract 75.50 and 82.31 % — non-nitrogenous extracts 53.49 and 50.85 % — cellulose 48.9 and 50.57 % — inorganic matter 49.7 and 50.63 %.

II. *Comparative Determinations of the Digestibility and Metabolisable Energy of Green Oats and Tares, Oat and Tare Hay and Oat and Tare Silage.* — The two sheep on which the preceding test had been made which gave remarkably concordant results, thus proving that they had the same digestive capacity, were used in these new tests. The oat plus tare mixture was fed as green fodder, hay or silage, during successive experimental periods of 14 days, in quantities of 4 — 1 — 3 kg. per head per day respectively, and contained, respectively, 1.299 — 0.840 — 0.819 kg. of dry matter.

The digestibility of the green fodder for each sheep was : total dry matter 63.86 and 64.7 % — organic matter 65.65 and 65.5 % — raw protein 61.53 and 63.1 % — ether extract 52.04 and 51.9 % — non-nitrogenous extracts 77.03 and 76.5 % — cellulose 48.37 and 47.6 % — inorganic matter 42.82 and 42.2 %. Applying the calculation to dry matter, there were the following average digestibility values : raw protein 6.83 % — ether extract 1.57 % — non-nitrogenous extracts 38.42 % — cellulose 13.39 % — starch equivalent (KEILNER) per 100 gm. of dry matter 44.92.

The digestibility of hay for each sheep was : total dry matter 65.15 and 65.0 % — organic matter 66.58 and 66.1 % — raw protein 69.00 and 68.2 % — ether extract 37.32 and 36.8 % — non-nitrogenous extract 71.70 and 71.3 % — cellulose 59.12 and 58.7 % — inorganic matter 52.09 and 53.6 %. Applying the calculation to dry matter, there were the following average digestibility values : raw protein 9.48 — ether extract 0.77 — non-nitrogenous extracts 32.66 — cellulose 17.06 % — starch equivalent (KEILNER) per 100 kg. of dry matter 43.24.

The oat plus tare silage was very successful. It contained 72.7 % of moisture, and the dry matter was composed of 12.55 % of raw protein — 4.32 % of ether extract — 45.57 % of non-nitrogenous extracts — 29.44 % of cellulose — and 8.12 % of inorganic matter.

The digestibility of the silage for each sheep respectively was : total dry matter 64.38 and 64.1 % — organic matter 66.09 and 65.9 % — raw protein 64.73 and 65.1 % — ether extract 73.04 and 73.4 % — non-nitrogenous extracts 70.96 and 70.5 % — cellulose 57.62 and 57.1 % — and inorganic matter 45.04 and 43.7 %. Applying the calculation to dry matter, there were the following average digestibility values : raw protein 8.18 % — ether extract 3.17 % — non-nitrogenous extracts 32.13 % — cellulose 16.81 — and inorganic matter 3.55 %. Starch equivalent (KEILNER) per 100 kg. of dry matter 45.59.

The metabolisable energy per 100 kg. of dry matter was : green oats plus tares : 256 870 high calories — oat hay plus tare hay : 249 950 high calories — oat plus tare silage : 259 080 high calories.

Another feed test was made on the same animals with oat plus tare silage and the silage feeds of the preceding year. The latter differed from the others because : 1) they had been cut when ripe, i. e. when the oats

had passed the milky stage and the tares were in full seed, instead of being cut when the tares were in full flower and the oat grain beginning to become milky ; 2) they had been left to dry on the field for 1 or 2 days before being silaged, instead of being silaged 3 hours after having been cut ; 3) an ordinary silo had been used, in which the maximum temperature of fermentation obtained was 35° C, instead of a small test silo, in which the maximum temperature was 25° ; in the first case the silaged feed was brown, in the second, green and sweet smelling.

The results obtained with the silaged feeds the preceding year were distinctly inferior to those given above which is somewhat remarkable, seeing that they had been silaged under what are generally considered better conditions. By cutting the feeds to be silaged earlier, the yield is slightly less, but much more appetising and considerably more digestible.

F. D.

1191 - Digestibility of Several Lupine products after their Bitterness had been removed, and their Utilisation in Milk Production. — MORGEN, A., WIND HEUSER G., SHOLER, G. and OHLMEYER E. in *Die Landwirtschaftlichen Versuchs Stationen*, Vol XCIX, fasc 6, pp 296-357 Berlin, 1922

Feed test in 1920-1921 at the Wurtemberg Agricultural Experiment Station at Hohenheim. The lupines had been rendered free of bitterness by the method suggested by Prof BERGELI (1) The products were: 1) coarse seconds obtained by grinding lupines still green but deprived of their bitter taste, they retained all the parts of the seeds, including the tegument ; 2) fine seconds, obtained like the foregoing, but better ground ; 3) lupine flour, fine, yellow, obtained by grinding lupines deprived of their bitterness and husked ; the bitter taste had almost completely disappeared, this was also determined by dosing with alkaloid by the MARCH and LEDERER method (*Landw Versuchsstationen*, vol. 98, p. 117) which gives the percentages of 0 to 0.05 %.

The ration also included other feeds, such as: separated straw, potato mash and boiled potatoes, soy cake, beet tops chopped and dried with the leaves.

A series of tables shows the following results: composition and digestibility of each feed and the rations; quantity and composition of the excrements, utilisation of each feed; milk production in the tests made with ewes and goats; analysis of the milk; difference in yield of milk and its constituents obtained by feeding urea and lupine flour or seconds, or the maintenance ration only (tests on goats); analogous comparison between urea and lupine flour or cake on the one hand and soy cake on the other.

*Lamb tests.* — Initial live weight 70-81 kg. Daily ration per head

(1) Described by BRAHM in *Zeitschrift für angewandte Chemie*, 1922, p. 45. As to the other methods for depriving lupines of their bitter flavour, see Feb 1921, No 119, MAX KLING, *Die Kriegsfuttermittel*, Stuttgart, Eugen Ulmer, 1918, Prof. A. BRUTTINI, *Ramassage et utilisation des déchets et résidus pour l'alimentation des hommes et de animaux, pour les égarés et les industries agricoles* Rome, International Institute of Agriculture, 1922

1) maintenance ration, 400 gm. of meadow hay plus 600 gm. of separated straw; additional ration of 250 gm. of lupine flour or 400 gm. of lupine coarse seconds; 2) 500 gm. of hay plus 500 gm. of beet tops and leaves, chopped and dried; 3) 1000 gm. of mixed feeds (equal parts of beet tops and leaves chopped and dried and lupine fine seconds) plus 300 gm. of hay.

The coefficients of digestibility obtained were: 1) Lupine flour: raw protein 99.7 %, pure protein 99.7 % (allowance made for the products of metabolism); fats 96.5 %, nitrogen-free-extract 87.3 %. 2) Lupine fine seconds: raw protein 96.2 %; pure protein 96.1 %; fats 79.4 %; raw fibre 84.8 %; nitrogen-free-extract 86 %; 3) Coarse seconds: 95.2-96.4 %; 95.2-96.1 %; 68.6-81.9 %; 96 % and 97-95.1 % respectively. There was a very high degree of digestibility, therefore, for husked lupine flour and a rather high degree for all the constituents of unhusked lupine seconds.

*Swine tests (1).* — Two animals of an initial weight of 26 and 27 kg. respectively received each day, one, 500 gm. of lupine fine seconds plus 800 gm. of boiled potatoes, the other, 400 gm. of boiled potatoes plus 1000 gm. of the mixed feed described above. The coefficients of digestibility were: Lupine fine seconds: raw protein 96 %; pure protein 96.5 % (corrected); raw cellulose 71.2; nitrogen-free-extract 82.9; mixed feed (seconds plus beet tops). 92.69, 2.6 — 91.7 — 61.5 — 87.80 respectively.

Lupine tests on swine, therefore, also show good digestibility, especially in the case of proteins.

*Rabbit tests.* — Two animals of an initial weight of 3 and 3.3 kg. respectively received, in one test, coarse lupine seconds; and in another, the above-mentioned mixed feed. The coefficients of digestibility for the seconds were: raw protein 98.2 %; pure protein 98.1 % (corrected); fats 93.5; nitrogen-free-extract 79.7, and for the mixed feed: 97.1 — 97.0 — 50.0 — 80.7 respectively.

*Sheep tests.* — The basal ration per head per day consisted of 650 gm. of meadow hay plus 500 gm. of straw; the additional ration — 216 gm. of lupine flour or 354 gm. of lupine coarse seconds, or 250 gm. of soy cake plus potato mash arranged so that the starch and the pure digestible albumen contents were equal in all rations. Initial weight 54-59 kg.

Basing the value of the rations on the quantity and composition of the milk produced, it was seen that lupine flour and seconds are on an average about equal to soy cake; the first two, however, seem to be more favourable than the last for the formation of fats in milk.

*Goat tests.* — In some tests lupine seconds and flour as well as soy were fed as a partial substitute for a basal ration poor in proteins, and also partly as an additional feed added to this maintenance ration. As a basal ration all the animals received 500 gm. of meadow hay plus 400 gm. of straw; two of them also received 400 gm. of potato mash or 304 gm. of

(1) See R. July, 1921, No. 737. (Ed.)

boiled potatoes, the quantity of which was progressively diminished when lupine flour or seconds, or soy cake, were fed, but was such that the starch of the ration was always equal.

In the case of goats also, lupine seconds and flour were almost equal in value to soy cake, though slightly less than in the case of sheep. Here also it seems that lupine products particularly favour the formation of fats in the milk.

In conclusion, lupine products, deprived of their bitter flavour, form an excellent protein feed, accepted by all the animals, which can be easily kept for a long time, is very digestible both for ruminants and swine and is almost equal to soy cake in favouring the secretion of milk.

F. D.

1192 - **Cocoanut Cake as Feed for Milch Cows and Breeding Stock generally.** — WOLL, F. W. in *Collection of Agriculture, Agricultural Experiment Station, Berkeley, California, Bulletin No 335*, pp 241-254. Berkeley, Cal Nov 1921

Information on the origin, composition, digestibility and food value of cocoanut cake; report of 2 feed trials on milch cows with rations containing this cake; its value as a feed for milch cows and other breeding stock (horses, swine and poultry).

The importation of cocoanut cake in the ports of the Pacific in the United States reached 201 360 t. in 1918 and 161 240 t. in 1920, it may be assumed that this consumption will show a constant increase.

According to analyses made in recent years by the "Division of Nutrition" of the University of California, and by the "State Bureau of Food and Drugs" of the same State, the average maximum and minimum percentage composition of ground cocoanut cake is, respectively: moisture 10.55, 6.9, 16.7 — proteins 20.69, 18.5, 22.4 — fats 8.78, 6.5, 10.7 — cellulose 9.60, 5.7, 14.7 — nitrogen-free-extract 44.41, 39.6, 49.5 — ash 5.97, 5.1, 7.0.

The average digestibility determined by several investigators for oxen, sheep and swine is: dry matter 82 % (from 75 to 90) — raw protein 85 % (from 75 to 90) — fats 98 % (from 96 to 100) — cellulose 50 % (from 23 to 73) — non-nitrogenous extracts 83 % (from 80 to 87). Nutritive ratio 3.5. These data compare very well with those of the commonest concentrated feeds. Both in digestibility and in its total nutritive constituents, cocoanut cake approaches cotton cake and barley and is a little superior to wheat-bran and dry beet pulp.

In the first test, 3 groups of 8 cows received a mixture of: maize bran 300 parts by weight *plus* crushed barley 210 parts *plus* cotton cake 200 parts *plus* dry beet mash 300 parts. In all, the cows received 7 kg. of concentrated feeds per kg. of butter produced; in one group 2 kg. and in another 4 kg. of this quantity of concentrated feeds were cotton cake. The time during which the test lasted was divided into 2 periods of 6 weeks each, during which the 2 groups receiving the two different quantities of cocoanut cake were interchanged. In addition to the concentrated feeds, all the cows received lucern hay and sugar sorghum silage.

The second test was made with 2 groups of 6 cows, which received

during the first period, in addition to the lucern hay and silage, the ordinary standard mixture of concentrated feeds, and during the second period, the same mixture to which cocoanut cake had been added; and the 2 feeding periods were interchanged for the 2 groups. The concentrated feed mixture composed of: 120 kg. of wheat bran *plus* 140 kg. of crushed barley *plus* 100 kg. of cotton cake *plus* 100 kg. of dry pulp. The amount of concentrated feeds given was 7 kg. per kg. of butter produced; when cocoanut cake was fed, 2 kg. of the concentrated feed ration were replaced by the same weight of cocoanut cake for all the cows except those which received 3 kg. or more of concentrated feeds per head per day. The former had 1.5 kg. of cocoanut cake per head per day in place of an equal weight of concentrated feed mixture.

In the first test, the daily average production per head for the 3 groups respectively was (control — ration of cake — double ration of cake): milk 8.5 kg., 8.9 kg. and 8.1 kg. — milk solids 1.139 kg., 1.243 kg. and 1.141 kg. — milk fats 351, 412 and 384 gm. Relative value of the rations: consumption per 100 kg. of milk 181, 192 and 202 kg. of the dry matter of the feeds — 105, 114 and 111 kg. of digestible dry matter; consumption per kg. of milk fats 42.9 kg., 41.2 kg. and 42.3 kg. of dry matter — 24.9 kg., 24.5 kg. and 25.3 kg. of digestible matter.

In the second test the daily average production for the 2 groups respectively was (ration with, and ration without, cocoanut cake) milk 13.5 kg. and 13.7 kg. — milk solids 1.73 kg. and 1.71 kg. — milk fats 495 and 504 gm.

The results of the 2 tests prove that feeding with cocoanut cake tends to slightly increase the fat content of the milk and to reduce the natural decrease of lactic secretion in proportion to the duration of such feeding. The rations containing, in addition to the standard mixture used by the Californian breeders (barley *plus* bran *plus* cotton cake *plus* dry pulp), a supplementary ration of cocoanut cake, proved rather superior to those without it. Nearly all cows will eat about 1 kg. per day of this cake, but some refuse double the quantity, even when mixed with the feeds they prefer.

F. D.

1193 — **The Asphodel as a Food for Animals.** — MARCHAND, G., in *Bulletin de la Société d'Histoire naturelle de l'Afrique du Nord*, Vol 13, No 6, pp. 202-205, 1 fig. Algiers, 15th June 1927.

The aqueous or alcoholic extracts of the tubercles, flowers and leaves of the asphodel are not poisonous for animals. The tubercles were eaten by man in ancient times and are so even up to the present day by certain tribes such as the Tuaregs. Many domestic animals (swine, goats, oxen, mules, dogs, chickens, ducks, etc.), feed on them. As these tubercles contain a rather large quantity of inulin, they may be used with advantage in time of famine for feeding livestock and even for human consumption.

Peeled, boiled and crushed and mixed with a little barley, the tubercles were always freely eaten by a chicken, on which the writer experimented, 140-160 gm. per day being consumed. The bird fattened on it, but less so than the control.

L. V.

## 1194 - Albumen replaced by Urea in the Food of Milk-producing Animals (1). —

I. MORGEN A., WINDHEUSER, C. and OHLMER, E., Über den Ersatz von Eiweiss durch Harnstoff bei Milchtieren, *Die Landwirtschaftlichen Versuchstationen*, Vol. XCIX, Part. 6, pp. 359-366. Berlin, 1922. — II. HANSEN, J., Fütterungsversuche mit Harnstoff bei Kühen, *Deutsche Landwirtschaftliche Tierzucht*, Year XXVI, No. 32, pp. 313-315. Hanover, Aug. 11, 1922.

I. — Feed test made in 1921 at the Agrarian Experimental Station at Hohenheim (Wurtemberg) on a sheep and five goats. Comparative tests were made with urea and soy cake.

The sheep received: 650 gm. of meadow hay plus 500 gm. of straw plus 500 gm. of potato mash; during the period of substitution, 39.1 gm. of urea took the place of 76 gm. of mash; the starch value thus remained the same.

Four goats received 500 gm. of hay plus 400 gm. of potato mash, which were afterwards replaced by 304 gm. of boiled potatoes; during the periods of substitution, 200 gm. of soy cake were given instead of the 304 gm. of boiled potatoes, or 31.3 gm. of urea instead of 46 gm. of boiled potatoes. The fifth goat only received, as basal ration, 500 gm. of hay plus 400 gm. of straw; and in the periods when a complementary ration was also given, it received 200 gm. of soy cake plus 126 gm. of boiled potatoes, or 31.3 gm. of urea plus 242 gm. of boiled potatoes. The digestibility results of the rations are given in Table I.

TABLE I. — Feeding tests on a sheep and five goats: comparison between the fundamental ration, the ration with protein substances (soy cake) and the ration with urea.

	Sheep		Goats		
	Fundamental ration	Ration with urea	Fundamental ration	Ration with soy cake	Ration with urea
Starch content of ration in kg. per 1000 kg. of live weight . . .	12.1			13.7	
Pure digestible albumen per 1000 kg. of live weight:				(maximum 14.7; minimum 12.9)	
calculated from the nitrogen of the excreta, insoluble in peptone. . . . .	1.56	1.52	1.71	3.75	1.66
calculated from the total nitrogen of the excreta . . .	1.37	1.33	1.51	3.54	1.45
Total raw protein digested per 1000 kg. of live weight . . .	2.53	4.59	2.93	5.14	5.26 (1) 6.49 (2)
Nutritive coefficient . . . . .	1:10.1	1:9.8	1:10	1:4.1	1:9.8 (1) 1:9.5 (2)

(1) Normal amount 31.3 gm. — (2) Large amount of 47 gm.

(1) See R. Nov. 1921, No. 1147 (Ed.).

Taking the figure 100 as representing the milk yield and each of its constituents for the periods during which the basal ration only was given, Table II shows the results obtained for the period during which urea or soy cake were fed.

Compared with pure albumen (= 100) urea, in the tests made in 1921 on goats, gave an average of: milk, 83; dry product 93; fats 105; and nitrogen 95. The average figures given by the test made in 1918-1920 were respectively 86 — 89 — 102 — 92. The results therefore correspond sufficiently.

Finally, it has been proved that albumen may be to some extent replaced by urea without reducing the milk yield, and that the price alone will enable it to be decided whether this substitution is advantageous or not. Large quantities of urea, however, should be avoided.

TABLE II. — *Milk production obtained with urea or soy cake as compared with the fundamental ration alone (= 100)*

	Milk	Dry Products	Fats	Nitrogen
<i>Urea</i>				
Sheep . . . . .	137	141	141	137
Goats . . . . .	97	104	118	109
<i>Soy cake</i>				
Goats . . . . .	115	111	108	112

II. — Numerous feed tests on cows with urea, at the Agricultural Institute of the Königsberg University. For some cows the test lasted 18 months; in some cases only 100 gm of urea per head per day were given, and never more than 200. This product was always mixed with the fundamental ration (mangold, potato refuse and finally, concentrated food) and this mixture was given twice a day in equal parts, morning and evening. In addition, each cow received 50 gm of salt.

The total period in which urea was fed amounted to 1872 days. All the cows, without exception, willingly took feeds mixed with urea. There were no cases of indigestion being caused through this product; there is no harm therefore in giving urea to cows so long as the dose does not exceed 200 gm. per day.

The results of these tests are as follows:

- 1) It is very probable that when there is an insufficiency of albumen, not only the starch in the ration but also urea may be used.
- 2) So long as the feeds contained a sufficient quantity of carbohydrates, the cows tested, even when they only received a fundamental ration in which albuminoids were too scarce for the maintenance and production of milk, but which was completed with urea, gave a milk yield little if at all inferior to that obtained by a ration sufficiently rich in albumens.

3) The addition of urea to a ration poor in albumens but containing sufficient starch, increases milk production and its fat content. Urea only has this effect on ruminants and is explained by the activity of the schizomycetes in their digestive organs. A certain quantity of nitrogen, it is true, is more efficacious in the form of albumen in the feeds than in that of urea, but the latter may replace the former to a considerable extent without interfering with production.

5) The increase in weight by the use of rations sufficiently rich in carbohydrates, is lower when urea is added instead of albumen. The milk, however, does not seem to form at the expense of the proteids accumulated in the organism. The cows tested, indeed, generally showed a slight reduction in weight during the first weeks of the test with a ration containing urea; but there was an increase of weight afterwards, though not much.

6) Where feeds are rich in carbohydrates but poor in albumen, urea may be of practical value (1). F. D.

#### PIG BREEDING

1195 — **Swine Heredity: Swine as a Reserve Stock for Experiments in Heredity.** — NACHREIM, H., in *Zeitschrift für Schweinezücht.*, Vol. XXIX, No. 5, pp. 65-71, 2 figs Neudamm, March 15, 1922

The beginnings of the present science of heredity date from the year 1900. The theoretical progress made during the last 20 years, however, has generally been based on experiments made on such animals as guinea pigs, mice, etc., which are very prolific, increase rapidly and cost little to breed.

For this reason our knowledge of the heredity factors of swine breeding, which is of such importance in farming, is slight and disconnected.

An increased knowledge would, however, be very important from a practical point of view, for it would ensure much more satisfactory results than those at present available, and breeds could be modified at will.

Some data are available on the transmission of colour: for instance, a cross between a Berkshire and a white pedigree pig nearly always results in white young, very rarely in spotted, and never in black. No experiment has been made as yet on the influence of heredity on the first and second hybrid generations.

From the farmer's point of view, a knowledge of the hereditary transmission of the number of teats is much more important; experts generally keep this in view and only rear sows with a number of teats not less than a given minimum, but it would be very difficult to find a breeder who notes the variation of this number in the boar and in the young of the boar and sow in order to gain useful information regarding further breeds.

It would be valuable from the statistical point of view to collect these data, and would allow a scheme to be drawn up for the hereditary transmission of the number of teats.

(1) For a description *in extenso* of these tests see: G. OLDEMBURG: *Landwirtschaftliche Jahrbücher*, vol. LVII, fasc. 2 — Berlin, P. Parey, 1922. Another urea test on a cow was made with much success by VOLTZ. see R. Nov. 1921, No. 1147. (Ed.)



Another important factor is the power of reproduction; but researches and observations on this subject are rendered rather difficult owing to its complex nature. The above-mentioned factors and others, such as resistance to disease, the nature, quality and quantity of the meat and fat, are heredity factors of which it would be very useful, from the practical point of view, to know the action and mode of transmission.

On these subjects, and with the aid of the Prussian Ministry of Agriculture and the Experimental Station for Swine Breeding at Ruhlsdorf, the writer has begun research work, the results of which he will give in future articles.

E. F.

1196 - **Investigations on the Growth of Livestock.** — SCHMID, A., in *Landwirtschaftliches Jahrbuch der Schweiz*, Year XXXVI, No. 3, pp. 311-403. Berne, 1922. (Report presented by the Central Department of the Federal Agricultural Experiment and Analysis Stations)

BREEDING  
CATTLE

The writer highly recommends the taking of the body measurements of livestock. By putting the classification on an objective basis, a better scientific description of the forms of livestock may be obtained. The investigations are of special importance in connection with the growth of females of the red spotted Simmenthal breed. The method differs from the previous methods in the fact that periodical measurements are started from the third day after the birth of the calf, and continue up to the age of 6 years.

The investigation was completed by the regular weighing of the animals and during the first year careful observations were made by means of monthly measurements. In all, 111 body measurements were taken, of which 84 have been utilized in this study. The principal object of these investigations is to encourage a uniform method in enquiry which will be in conformity with the practical needs of breeding. At the same time the writer gives a characteristic and exact description of the Simmenthal cattle from their earliest age to the adult stage, with the periodical modifications in their external form.

The summarized results show that during the first year the measurements of height, and during the second and third years those of width and length, show the greatest increase. During the fourth year, on the contrary, the length is of most importance.

In the chapter dealing with the application of the results of these investigations, practical conclusions are given regarding breeding and feeding, judging of cattle and the periodical increase in growth of the animals. The writer calls special attention to the tardy growth caused by premature weaning or weaning for too short a period and by changing feeds too quickly.

In order to facilitate the more detailed study of the results 8 tables are given showing the averages of growth during the different periods and 7 other tables with graphs showing the modification of growth. In addition, a table based on the relation between the average body measurements and the average height of the withers gives in a striking way the chief results of these experiments.

A.

## CATTLE

1197 - **Zebu Selection for Milk Production in Brazil.** — *A Fazenda moderna*, Vol VII, No 7, 5 pp, 4 figs Rio de Janeiro, July 1922.

M. JOÃO DE ABREU has experimented in the selective breeding of the zebu for milk production on his "Fazenda Itãoca" at Boa Sorte (Leopoldina, Rio de Janeiro State). By his choice of breeding stock, proper care in rearing and abundant reeding he has obtained a herd remarkable not only for its high milk yield but also for its docility. In a check milking test (once a day for two consecutive days) 3 pure-blooded female zebus produced an average of 5.4 litres per head at each milking; 19 females of  $\frac{1}{3}$  zebu blood and  $\frac{1}{3}$  European milch breed yielded an average of 4.9 litres per head at each milking, and 11 females of  $\frac{7}{8}$  zebu blood and  $\frac{1}{8}$  European milch breed, 5.5 litres per head. The highest yield (7 litres the first day and 8 litres the second) was given by a female of  $\frac{3}{4}$  blood, no milking yielded less than 3.5 litres of milk. F. D.

1198 - **Comparative zootechnical Value of the Zebu and the Ox.** — CAVALCANTI, P., *Lavoura e Criação*, Year VII, No 6 pp 117-112 1 fig Rio de Janeiro, June 1922

The Brazilian Ministry of Agriculture has entrusted the «Posto Zootechnico» at Pinheiro, of which the writer is Director with a series of experiments for the purpose of determining the value of the zebu for the improvement of stock-breeding. In the 1921 Report, presented to the Director of the «Serviço de Industria Pastorial», the writer examines the much-discussed question of the specific name to be given to the zebu and whether it should be considered as a species or that the view of TAMPELLINI that the zebu and its varieties are simply different types of the *Bos Taurus* genus is correct.

The measurements taken by the writer of 20 prize animals and 10 bought by the Brazilian Ministry of Agriculture, proved that the form of the zebu is asymmetrical, i. e. does not correspond with the correct zoometrical proportions.

The following table shows some of the measurements:

*Measurements of zebu bred by selection.*

		5 year-old Males	1 year old Males	3 year-old Females
Height to withers . . . . .	m	1.47	1.19	1.25
Length of trunk . . . . .	"	1.75	1.23	1.38
Height of breast . . . . .	"	0.79	0.53	0.60
Measurement round breast	"	2.40	—	—
Front width of breast . . . .	"	0.52	0.38	0.38
Width of pelvis . . . . .	"	0.57	0.30	0.32
Width of croup . . . . .	"	0.55	0.34	—

The zebu when kept in the stable, requires more intensive feeding than the ox and shows a slighter increase in weight in proportion to the food consumed, which tallies with its large skeleton. The average weight at

birth was 26 kg. ; at 3 months 65 kg. ; at 6 months 141 kg. ; at 9 months 211 kg. ; at 24 months 315 kg. ; and at 36 months 316 kg. The ratio of nutrition in the rations consumed in the periods between these ages was respectively : 1 : 5.0 — 1 : 4.8 — 1 : 3.4 — 1 : 3.6 and 1 : 4.8.

In one test, 5 female zebus and 5 cows were kept on the same scanty-pasture from October to December : the first weighed, on an average, 285 kg. before going out to grass and 303 kg. after ; the second, respectively, 260 and 405 kg. Even on pasture therefore the zebu is very inferior to the ox in the utilisation of feeds. On the other hand, it shows greater resistance to tick and other external parasites. Dutch cows are particularly subject to such attacks, while Limousine cows are less liable than the other European breeds tested, viz. Hereford, Schwytz and Dutch.

In Brazil cattle are bred chiefly for meat and for work. Zebus are not suitable as store cattle because their utilisation of feeds is slow and poor. The writer therefore advises a very limited use of them for crossing with European cattle, and among these a choice for this purpose of small types, of which it is desirable to increase the frame. A first generation crossing may be tried, followed by cross breeding for the market with European store cattle. This method will be tested at the « Posto Zootecnico » at Pinheiro. F. D.

1199 - **The pure-bred Cattle of Glan-Donnersberg (Palatine)** — BISSKUCHEN ED. (Tierzuchtinstitut der Technischen Hochschule, München, in *Deutsche Landwirtschaftliche Tierzucht*, Year XXVI, No. 17, pp. 262-265, 3 figs., Hanover, July 7, 1922)

Little has been published on the Glan-Donnersberg breed of cattle, which is rather numerous in the Rhine Palatinate and the neighbouring Rhine provinces ; nor is it so important as the black spotted and Simmenthal breeds. In West Germany this breed cannot be replaced, even by the Simmental, which is inferior, from the point of view of acclimatization, hardiness, economy and production.

The history of this breed only dates from 1750. Previously regulations as to the keeping of bulls and pasturing already existed ; but no mention is made in them of the Glan-Donnersberg breed. It may therefore be taken as a fact that it belongs to the breed which spread all over the South of Germany after the Thirty Years' War. It is divided into the Glan and Donnersberg varieties, because in the first district it was crossed with the Schwytz breed and in the second with the Bernese.

Owing also to the fact that the forage of the district is more nourishing and richer in lime, the Donnersberg type soon became larger and heavier than the Glan. In the latter district there are more small holdings, and the cattle, especially the milch-cows, are put to work before they reach maturity.

The first to introduce cattle breeding from foreign countries was Duke Christian IV (1742-1775). He imported Swiss and Frisian cattle at his own expense and afterwards presented them to communities and private persons free or at a very low price.

Rearing in the Palatine afterwards underwent many vicissitudes, and

the same remark applies to the attempts made a little later than 1860, and soon afterwards abandoned, at crossing the Donnersberg with Shorthorn. The breeding methods which have proved so successful since 1873, are due to Prof. MAY of Weihestephan. He proved that the defects attributed to the breed were not due to the breed itself but to the defective systems of rearing, and especially to insufficient food, errors in the rearing of young animals and the fact that the animals were put to work too early. For the application of the rules he had formulated, he founded two «Stammzuchtbezirke» (Societies for breeding pedigree cattle), one at Glan and the other at Donnersberg, and these were extended continually by the formation of new societies.

These institutions endeavoured to attain the object for which they were established by purchasing better breeding cattle, by offering prizes to breeders who kept bulls for a considerable period, by organising fairs and by awarding money prizes to breeders who exhibited pure-bred, well-formed and properly reared animals, etc.

The application of the same improvements in the rearing of the Glan and Donnersberg breeds rendered the type more and more uniform; and in 1898 the Society for Breeding Glan-Donnersberg cattle was founded with its headquarters at Kaiserlautern, its object being to raise pure breeds and improve existing breeds.

Milking tests had been undertaken some time before the war in order to improve milk production. Some attempts were also made to provide common pasture grounds, not all the numerous small farmers possessing sufficiently extensive grazing lands.

The following averages from measurements taken by the writer of more than 100 cows will give an idea of the typical conformation of these animals:

Height at withers . . . . .	132.2	Depth of chest . . . . .	40.9
» of back . . . . .	131.4	Width of front ribs . . . . .	45.0
» » loins . . . . .	134.2	Measurement round chest . . . .	180.6
» at insertion of tail . . . .	138.6	» » cannon . . . . .	18.0
Depth of chest . . . . .	68.1		

The number of this breed decreased from 96,000 head in 1914 to nearly 80,000 in 1919.

It is especially a milk and meat producer, but it has other uses also and more than 30 % of the tillage of the district where it is reared is done by cows, and about 12 % by oxen.

The cows yield from 2000 to 3000 litres of milk annually: the general average is from 2400 to 2500, with an average fat content of 4 to 4.5 %. These results could be greatly increased by selection.

The colour of the coat varies from light yellow to deep red and the flesh is very tender. The animals are not completely fattened and before the war many of the store cattle were exported to France. An experiment made by a breeder proved to what extent these animals may be fatten-

ed : a calf weighing 55 kg. when 3 days old attained a weight of 446 kg. at the age of 1 year by intensive feeding. From 50 to 60 % are used as meat.

F. D.

1200 - **Cattle-Breeding in the Province of Padua.** — BIANCHI, G., in *Il moderno Zootatro* Series V, Year XI, No 7, pp. 153-168 Bologna, July 1922

The province of Padua has an area of 202,463 ha., of which the greater part is flat country ; culture, nevertheless, is very varied, and in this respect the province may be divided into 3 zones : the first, the Euganean hills, is formed chiefly of igneous trachytic rocks ; the second is an elevated plain formed of alluvial and rather shifting soil, and the third, a low plain formed of rather compact and firm clay detritus.

The cattle raised are : the Apulian breed (a Paduan variety), the Podolian breed and the Emilian

The Apulian breed predominates in the southern zone of the province ; their height varies from 1 40 to 1 70 m. ; the oxen weigh about 7 qx. and the cows 4 qx. They are of slow growth and great endurance but do not fatten to any extent, it is therefore advisable to employ them for labour and not as meat or milk producers, because the cow often yields insufficient milk for her calf. This breed is utilised on large farms situated on firm, clayey soil, where the work should be rapid and continuous ; where small or medium sized farms take the place of large ones, the breed has become finer, it fattens better and shows earlier development, being improved by individuals of the Romana variety, which are much finer than those of the pure breed

The Alpine breed is found in the North, while some branches are also met with in the South : on certain farms the grey type is seen, which often has the characteristics of the Bellune breed, sometimes also those of others. The animals of this type are excellent though slow workers ; they fatten rather quickly ; and the cows are fairly good milk producers. The brown variety are used exclusively for milk production and are classed under the three sub-types : Val Rendena, Borlina and Swiss. The first of these sub-types is disappearing ; the second is slight-limbed, small, disproportioned and black and white ; their milk yield is high, and was obtained after long selection. It was difficult to introduce the Swiss sub-type, but now the difficulties are gradually being overcome, and there are hopes that it may become widely diffused, either pure or crossed with the two preceding types, because they combine an abundant yield of excellent milk with a remarkable tendency to fatten.

The Jura type is fairly numerous and produces sufficient milk for the needs of the farmer and the calves ; it attains an average weight of 9 qx., and may also be employed to a certain extent in work.

The Emilian breed has recently been imported on trial and is not numerous.

Cattle-breeding is carried on in stalls. The stalls leave much to be desired from the point of view of position, size and hygiene. They are almost always made of stone and are damp and insufficiently sloped for

the water to drain off ; the ceiling is too low and the openings are too narrow to ensure sufficient ventilation.

In spring and summer, the feeds include red clover, vetch, rye, barley and seed-hay ; in winter, sometimes straw, but more often stubble, reeds, maize spathes and wheat straw. These feeds are roughage of low nutritive value badly kept and are not prepared in any way. Trade offal, such as beet mash, malt and marc (the residue of pressed fruit), are also given, but not supplemented by matters rich in protein. At the end of winter the animals are generally much weakened. Mountain pasturing (" alpage "), which was also carried on before the war in the district of Cittadella, became extensive in 1921 ; more than 1500 oxen remained in the ' Malghe ' (a cattle enclosure) from June to 21st September. The cheese industry is but little developed, a very savoury kind of cheese called Asiago cheese is made. There are very few cooperative dairies. The trade in livestock is carried on at the fairs and markets of the county town and other centres, the Padua market, which exports to other provinces, should be noted.

Here and there in the province there were some mutual livestock insurance companies, but few of them prospered and they have had no influence in improving hygienic and breeding conditions. For some time past mutual non political associations have been formed through the propaganda of the itinerant chair of Agriculture, they have been united in a provincial federation, presided over by a veterinary surgeon. Up to the present, cattle breeding in the Province of Padua has not been developed as much as it should have been, owing largely to the mixture of breeds of cattle and the lack of method of the breeders. The Stock-Breeders Association of Padua (which distributes stock-breeding publications and superintends the purchase and utilisation of improved breeding cattle), the Provincial Commission for the Improvement of Cattle (which makes an expert examination of bulls intended for public service and for approved breeding stations and also supplies young bulls for the improvement of breeds at special reduced rates), the Stock Breeding Section of the Itinerant Agricultural Instruction Department (which publishes practical and theoretical stock-breeding propaganda), the Agricultural Syndicate of Padua and the Mutual Cattle Federation of Padua encourage the initiative and efforts of the local breeders and direct them towards one object, namely, the improvement of local cattle-breeding.

E. F.

1201 - **Feeding Tests on half-breed Store Cows in Calif.** — SHEETS, F. W and TUCKWILLER R. H., in *United States Department of Agriculture, Bulletin No 1124*, 17 pp Washington, Feb. 1922

This work is divided into 2 parts : 1) rations, increase or decrease of cows' and calves' weight produced by these rations ; 2) cost of production of rations and rearing of calves until weaned. The results are set out in a series of tables and the value of the rations and their cost is discussed with reference to the increase of weight.

These feeding tests were made in co-operation with the Experimental

Agrarian Station of Western Virginia in the South-East part of this State. They were repeated during a period of 4 years for 132 days per ann on an average during the winter. Half-breed Shorthorn, Hereford and Aberdeen-Angus cows were used, of which the average weight at the beginning of the tests was 379 kg, and which generally were to calve the following spring or at the beginning of the summer.

For each feeding period the cows were divided into 4 uniform groups of 10 each. During the summer the cows and their calves were sent to grass on good meadow pasture (*Poa pratensis*) and white clover. After the first year, the ration of the fourth group, composed of "shock corn" (i.e. maize reaped when in the ear and ripe plus a mixture of hay plus wheat straw), was replaced by one containing maize silage, the price of which is lower and its nutritive value superior. The hay mixture contained approximately equal parts of cat's tail grass (*Phleum pratense*) and clover. Analysis showed that the feeds used, with the exception of the cotton cake, were of rather inferior quality. In the following tables the average quantities of feeds consumed during the four years are shown with the exception of those of the fourth group, which were given for one year only.

TABLE I      *Seeds consumed per 1000 kg of live weight per cow and for each calf born*

Group	Ration	Feeds per 1000 kg of live weight per cow		Consumption per calf born
		Total	per day	
		kg	kg	kg
1	Maize silage	3688	27.9	1379
	Mixed hay	1252	9.5	477
	Wheat straw	421	3.2	161
2	Maize silage	3911	28.9	1552
	Soy hay	1201	8.9	455
	Wheat straw	362	2.7	162
3	Maize silage	3830	29.0	1645
	Wheat straw	1134	8.6	849
	Decorticated cotton cake	237	1.8	103
4	Maize in ear ('shock corn')	2172	17.8	923
	Mixed hay	1448	11.9	616
	Wheat straw	266	2.2	113

Those groups which suffered a loss of weight during the winter, showed the greatest increases in weight during the following summer, but those which slightly increased in weight during the winter showed the greatest increase at the end of the year for the whole year.

Basing the value of the different rations on the average weight of the

calves at birth and the cows' increase in weight during the winter and summer, group 2 ration ranks first; group 3 second; group 1 third; and group 4 last.

TABLE II. — *Daily ration given for 132 days during the winter to cows in calf, and change in their live weight.*

Group	Feeds	Daily ration	Increase (+) or loss (—) of live weight after 132 days
		kg.	kg.
1	Maize silage . . . . .	10 5	— 1 8
	Mixed hay . . . . .	3 5	
	Wheat straw . . . . .	1 2	
2	Maize silage . . . . .	10 9	+ 21 3
	Soy hay . . . . .	3 4	
	Wheat straw . . . . .	1 0	
3	Maize silage . . . . .	11 0	9 1
	Wheat straw . . . . .	0 7	
	Decorticated cotton cake . . . . .	3 3	
4	Maize in ear . . . . .	6 8	— 22 2
	Mixed hay . . . . .	4 5	
	Wheat straw . . . . .	0 8	

The results of the second part of the work show us that for half-breed store cows a winter ration consisting of maize silage with a mixture of hay, soy hay or cotton cake is much more economical than a ration of maize in ear ("shock corn") + mixed hay + wheat straw. The cows which, in addition to maize silage, received a mixture of hay or soy hay, produced calves whose live weight was much greater than that of calves produced by cows fed on cotton cake, so that the average cost of rearing these latter was about 6% in excess of the cost for the former. There is another advantage in connection with the hay of the first ration: it can be produced on the spot, which eliminates expense and fluctuations in price. F. D.

#### SHEEP

1202 — **Casual Flora imported into Germany in Wool and the Question of its Acclimatization.** — See No. 1151 of this Review.

#### PIGS

1203 — **Feeding Tests on Swine: Acorns as compared with Oats and Barley Seconds.** — MÜLLER and SANDBRING, in *Deutsche landwirtschaftliche Tierzucht*, Year 26, No 33, pp 325-326 Hanover, Aug. 18, 1922

Feeding tests lasting 4 weeks made at the "Versuchswirtschaft für Schweinehaltung, -fütterung und -zucht" (Experimental Station for Swine Breeding, Feeding and Selection) at Suhlsdorf (Teltow), from 10th February to 10th March, 1922.

The acorns and oat and barley seconds did not differ much as to their



digestible albumen content 2.7 — 7.2 — 6.1 %) and their starch value (52.4 — 59.7 — 72.0); the tests were made on 21 animals of 6 weeks, of an initial average weight of 48 kg. They were divided into 3 groups, which received: the first, 1 kg. of acorns, the second, 1 kg. of oat seconds and the third, 1 kg. of barley seconds per head per day; in addition, all received 125 gm. of fish powder plus 3 kg. of refuse potatoes, also a little chalk and some oat balls. The fish powder contained: 43.6 % of digestible protein, 1.2 % of fats and 6 % of salt. The average results were respectively for the 3 groups: initial weight, 44.7 kg. — 49.3 kg. — 47.4 kg. — final weight 51.3 kg. — 60 kg. — 59.3 kg.; average daily increase per head, 234 gm. — 377 gm. — 428 gm. The acorns, though eaten by adult animals, have therefore less than half the nutritive value of barley seconds as regards young animals.

According to LIEHMANN, oat seconds possess 70 % of digestibility and barley, 80 %, the results of this test confirm these figures. F. D.

1204 — **Rations for swine** — WILSON, J. W. and H. HUHLMAN A. H. in *Agricultural Experiment Station, South Dakota State College of Agriculture and Mechanic Arts Bulletin* No. 192 pp. 302-316. Brookings, South Dakota, 1921

The Bulletin is divided into two chapters: I) Protein supplements for swine kept on a maize field; II) comparison between fish meal and meat meal value of different barley preparations and value of the meadow grass for fattening swine.

I. 4 groups of 5 pigs each, weighing initially from 44 ½ kg. to 74 kg., were pastured on a field of ripe maize for a period of 45 days. The group which received no supplementary feed showed an increase in weight of 717 gm. per head per day; that which received linseed cake, 785 gm., that which received meat meal 1003 gm.; that which was pastured on a field of rape also, 774 gm.

Linseed cake was not taken so freely as meat meal; perhaps more would have been consumed and there would have been greater increases in weight if, instead of being broken up in pieces, it had been given in the form of a mash.

These results prove that sending swine to pasture on a field of ripe maize instead of giving them the grain, is good, inasmuch as it saves labour, manures of the field, etc.; its efficiency depends on the nature of the supplementary feed. Those breeds which develop early are the best; from such, fat stock may be produced at the beginning of the killing season, when the prices are highest.

II. — The second test was made with 7 groups of swine (64 in all), fed for a period of 105 days (summer-autumn). The feeds were distributed separately and the animals were left to feed at will. Those of the first 5 groups were not sent to pasture. The following daily average increases of live weight per head were obtained for the groups fed with different rations: 1) maize and meat meal ("tankage") 645 gm. — 2) maize and fish meal 666 gm. — 3) whole meal barley and meat meal 408 gm. — 4) whole meal barley flour (dry) and meat meal 604 gm. — 5) crushed whole-meal

barley and meat meal 558 gm. Fish meal therefore is equal, even slightly superior, to meat meal. Barley is practically equivalent to maize as a swine feed, but it must be ground. Those groups which received unground barley showed a tendency to consume excessive quantities of meat meal.

The 2 other groups were kept in a meadow (*Poa compressa*); one received a supplementary feed of maize and meat meal, the other ground barley and meat meal; the increase was, respectively, 777 and 686 gm per head per day. The groups sent to pasture consumed, as compared with those which only had concentrated feeds (1 and 6; 4 and 7), a larger quantity of food, but showed a greater increase of live weight, the greater economical value of pasture for swine is therefore confirmed.

The following table gives the consumption of feeds, in kg., per production of 100 kg. increase of live weight.

*Swine-feeding tests. Feeds consumed per 100 kg. increase of live weight.*

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Threshed maize .	334 31	346 81	—	—	—	319 44	—
Meat meal . . .	36 07	—	110 17	52 46	57 60	33 61	32 79
Fish meal . . .	—	25 48	—	—	—	—	—
Ground barley .	—	—	—	378 69	—	—	389 58
Barley meal . .	—	—	433 29	—	—	—	—
" "	—	—	—	—	402 40	—	—

F. D.

POULTRY  
REARING

1205 - **The Rearing of Geese in the United States.** - IER, A. R. in *Farmers' Bulletin* 767, United States Department of Agriculture, 22 pp., 12 fig. Washington, Jan. 1921 (Revised April 1922)

In the United States geese are reared most abundantly in the South and Middle West. According to the census of 1920, Illinois contained the greatest number of geese (195,769), followed very closely by Missouri, Arkansas and Iowa, and at a greater distance by Kentucky, Tennessee, Minnesota, North Carolina and Texas. During the last 10 years goose rearing has shown a tendency to greater extension in the Northern part of the Central States than in the Southern part. About a tenth of the farms in the United States rear geese.

Six breeds of geese have been admitted to the "American Standard of Perfection", namely, Toulouse, Embden, Chinese, African, Wild or Canada and Egyptian. Besides these the Sebastopol goose is also reared as well as hybrid varieties made by crossing the Canada with one of the above-mentioned breeds, generally the Toulouse or African. The African gander is occasionally crossed with the Toulouse and Embden, but never beyond the first generation; this cross is not generally advisable, and is suitable only for the production of geese intended for early killing or for fattening. The Toulouse and Embden breeds are the most extensively

raised. Geese are kept primarily for the production of flesh and feathers, while eggs are of secondary importance.

The standard weights of the different breeds for the adult gander, young gander, adult goose and young goose respectively are: Toulouse 12-9-9-7; Embden 9-8-8-7; African 9-7-8-6; Chinese and Wild or Canada 5.5-4.5-4.5-3.5; and Egyptian 4.5-3.5-3.5-3.

The writer describes each of these breeds, and in connection with rearing gives rules regarding the construction of houses or shelters, selection, incubation, feeding of goslings, fattening and plucking feathers.

In an appendix a list of 25 works issued by the United States Department of Agriculture on poultry raising and egg production is given.

F. D.

1206 — **Carp Breeding in Auvergne.** — LE FORT in *Bulletin de la Société Nationale d'Acclimatation*, Year 69, No 8, pp 153-154. Paris Aug 1922

FISH BREEDING

The writer describes the methods employed by L'HÉRITIER for intensified pisciculture in the Giat district (Puy-de-Dôme) and the magnificent results obtained in the ponds, which cover 102 ha and are situated at an elevation of 735 m. Each of these ponds is intended for a special culture, dependent on its size, position, production of animalculae, etc. Ingenious systems of gratings, open, moveable pens and eel dykes were used.

The following methods are advised by L'HÉRITIER: 1) draining dry during the winter, hence the annual fishing of the ponds; 2) three kinds of ponds prepared for spawning, rearing and fattening; 3) the utilisation of winter reservoirs, well-kept stew-ponds; 5) selection of the species employed.

F. D.

## FARM ENGINEERING

1207 — **The Production of Agricultural Machinery in the Ukraine.** — ISTOMIN D., in *Economicheskaja Izv* Moscow, Sept 9, 1922

AGRICULTURAL  
MACHINERY

At the beginning of 1922, almost the entire production of agricultural machinery had been monopolised by two syndicates -- the "Ukrainian Rural Syndicate of Machinery", in which the largest machinery manufacturing factories of Kharkow, Elisabethgrad, Berdiansk and Odessa participated, and the "Southern Syndicate of Agricultural Machinery" which included the 15 best manufacturing factories of the Province of the Zaporogues and the surrounding district. The factories which do not belong to these Syndicates have not yet been restored to working order or are not working owing to other causes, they are moreover of but very little importance in this connection.

The period between 1920 and 1921 may be considered as lost time both as regards the manufacture of agricultural machinery and its sale to farmers, production in 1920 scarcely reached 2-4 % of that before the war and the year 1921 was characterised by a complete cessation of sales. This fact explains how it came about that the Syndicates happened to have a certain amount of agricultural machinery at the beginning of 1922.

[1206-1207]

To give a clearer idea of the production of the Syndicate of manufacturers of agricultural machinery, compared with normal requirements before the war, the following table gives the figures for production in 1922 (these include the actual production for the first six months and the estimated production for the second half-year which according to the estimates should be almost double that of the first), the demand in 1920 and that of the period 1911-1913 according to the figures of the People's Commissary for Agriculture.

Kinds of Agricultural Machines and Implements	Normal requirements during the period 1911-1913	Actual Sales in 1920	Total production of the Syndicates in 1922	% of the produc- tion in 1922 relatively to the normal requirements in 1911-1913
Machines and implements for tilling the soil . . . .	500 000	17 000	50 000	10
Seeding machines . . . .	34 000	5 300	5 500	17
Harvesting machines . . . .	140 000	2 600	6 800	5
Threshing machines . . . .	15 000	5 800	4 000	27

It appears from this statement that the agricultural machinery industry of the Ukraine has before it the responsible task of reconstructing and developing its factories and of bringing the manufacture of agricultural machinery up to the normal level of the demand. I. G.

1208 - **Power Cultivation of Vineyards.** — DALMASSO, G., in *Giornale vinicolo italiano*, Year XLVIII, No. 17, pp. 162-164 and 172-171, 11 figs. Casal Monferrato, April 23, 1922.

The writer having had an opportunity of studying closely the problem of the power cultivation of vineyards in France, where the difficulty is increased on account both of the shortage of labour and the fact that cultivation is intensive, examines the problem from two points of view, namely:—

1) Should the vines be so planted as to leave the relatively wide space of at least 2 m. between the rows?

2) Should the vines be planted close with a spacing of 1.50 m. or less between the rows?

For the former and most favourable case, the writer gives a list of a few types of motor-ploughs and tractors with driving wheels or belt attachments, the use of which has given good results. These machines require, on an average, a motive power of 10 to 40 HP, and a total average weight of 1200 kg. Their average dimensions may be taken as:—length 2.50 m.; width 1 m.; height 1.50 m.

On the other hand in the second case the problem is much more difficult, as the machines are bound to have their dimensions reduced to a minimum; consequently their output decreases and therefore also their capacity for work.

The writer mentions some types of machines that are specially suited

to this kind of cultivation and for which the required motive power varies between 4 and 12 HP.

Most of these machines naturally belong to the type known as tractor push-ploughs, the operator walking behind the machine and holding the handles, much as in the case of the ordinary plough.

From this rapid examination, the writer concludes that in Italy the question of power cultivation in vineyards should not be neglected and that serious scientific experiments should be undertaken which would furnish positive and concrete data for making this system of vine cultivation practical.

G. D.

1209 — **Experiments with Milking Machines.** — I CHRISTENSEN, A, Description of the milking machines tested, — II LUND, A. V., Experiments with milking machines, — III THOLSTRUP PEDERSEN, The Content of Bacteria in the machine milked Milk, 108th *Compte rendu du Laboratoire experimental de l'Academie Royale veterinaire et agricole danoise*, a communication by BERTON ROSENKRANTZ, International Institute of Agriculture, Danish Office

I. — The writer describes the working principle of the *Dana*, *Manus III*, *Omega*, *Universal* and *l'accar* milking machines. The experiments indicated a vacuum of 400 mm in the *Dana* and 380 mm. in the other types.

II. — The writer made his experiments with the object of comparing machine milking with hand milking. After describing the methods followed in the experiment, he presents the following conclusions:— The yield by machine milking was, in the case of all the machines, less than that by hand milking, but the amount of the difference cannot be given in figures. At the time of changing the method of milking the decreased yield by machine milking was more than 0.3 kg to 0.5 kg. less than the yield by hand milking. With all machines, except the *Dana*, milking had to be finished by hand (after-milking). The quantity of milk milked by hand decreased as the cows became accustomed to the machine.

The following was the output of work during the experiments with the different machines:—

<i>Dana</i> without "after milking".	
4 machines milked	20-25 cows per hour
<i>Dana</i> with "after milking"	
6 machines milked	35 " " "
<i>Manus III</i> with "after milking"	
5-6 machines milked	30-35 " " "
<i>Omega</i> with "after milking".	
5-6 machines milked	30-35 " " "
<i>Universal</i> with "after milking"	
2 double machines milked	20-25 " " "
<i>l'accar</i> with "after milking"	
2 double machines milked	20-25 " " "

*Dana*, *Manus III* and *Omega* worked most rapidly. The two Swedish machines, *Manus III* and *Omega*, are more difficult to work than the others. The pails being under the cow during milking the machine has

to be attached to the latter, which means extra handling and to milk properly the tubes must fit closely to the udder. In using the *Vaccar* a support is necessary to keep the tubes close to the teats.

III. — According to the experiments made with milking machines (*Dana*, *Manus III*, *Omega*, *Universal* and *Vaccar*), — including calculation of the number of bacteria and tests by means of reductase -- it appears that these machines, unless they are carefully cleaned, cause the milk to contain many more bacteria than milk obtained by hand milking.

To get milk free from bacteria, thorough cleaning of the machine (1) is necessary as well as clean cows, and from this standpoint the construction of the machines is important; the simpler it is, the better it can be cleaned. All the machines, except the *Dana*, have a fixed tube, which is objectionable. In the Swedish machines the milk passes through too many joints and too many taps. A milking machine should be kept similarly to other apparatus and utensils in the dairy. After each milking the machine is rinsed in cold water, taken to pieces and washed with hot water and soapy water so as to remove all trace of milk. Each part is next steeped in hot water and pasteurised. The best method of pasteurising the tubes and rubber pipes is to place them for 15 to 25 minutes in a vessel of water at 65-70° C. Pasteurisation is most quickly done by steeping the parts in boiling water for 5 to 10 minutes. Only the best rubber stands such treatment indefinitely, while the celluloid used in the Swedish machines suffers badly from it.

1210 — **New Method for Draining Lees.** — PAUL, P., in *Revue de Viticulture*, Year 20, vol. LVII, pp. 152-154. Paris, Sept. 7, 1922.

The writer in collaboration with VENTRE has taken out a patent for the following method:— It consists in the use of special conical drainers which are gradually pressed into the cake of lees to be drained.

After a preliminary pressing without the wedges, 4, 6 or 8 pieces formed of two hollow pairs of wedges are placed on the cake. The pressure per centimetre is increased 5 to 10 fold, pressing is done simultaneously from above downwards and from right to left, the wine flows away by the drain. Each metre of drain having a volume of 50 l. allows 50 l. of wine to escape. The wine extracted is clear and normal. P. C.

1211 — **Experiments in Electro-culture.** — *Bulletin officiel de la direction de recherches scientifiques et industrielles et des inventions*, Year 32, pp. 360-482, 15 figs. Paris, June 1922.

Experiments made at Bellevue in the gardens of the Directorate of experiments and inventions of the Ministry of Public Instruction in 1920 and 1921. A plot of ground 12 m × 9 m. was selected, situated so as to have as much shelter as possible from wind. A second plot similarly situated served as control.

The apparatus used for the electric discharge utilised for the development of plants was the following:— a net-work of steel wires 0.2 mm. in dia-

(1) See R. May-June, 1922, No. 637. (Ed.)

meter stretched in parallel lines 0.35 m apart on thick steel wires 15 mm in diameter supported by posts placed at the corners of the plot. The thin wires are attached to the thick wires by means of spiral steel springs so as to maintain a suitable tension and the whole system is insulated.

The experiment shows that this arrangement is satisfactory even in damp weather, it does not however prevent loss of energy during constant rain. The network is connected electrically, by means of an aerial wire carefully insulated, to a high tension apparatus composed of a 3 kw transformer of which the primary is wound for a pressure of 110 volts alternating.

The secondary, in which the tension can attain 35 000 volts, is connected with a transformer. It is known that these installations consist essentially of a rotary multipolar commutator worked by a synchronous motor which receives the current used. To avoid sparking by short circuit it is advisable to reduce to a minimum the energy absorbed by the resistance of the air and to make insulation as perfect as possible.

The rectified current curve thus obtained is a sine curve developed always in the same direction but with intervals. It is understood that these intervals should be reduced to a minimum to avoid short circuits in the transformer, to effect this a condenser of suitably calculated capacity is placed in the circuit, it is charged during the active periods and gives back energy during the resting periods.

The frequency of the available current is 53 periods. The electric discharge of the installation took place every day for 4 hours from 6 to 8 o'clock a.m. and from 6 to 8 o'clock p.m. A few results obtained with this method are given and compared with those obtained in the control plot.

After having tried another scheme and made comparisons between the control culture and the treated culture, the writer states that it is necessary to make use of continuous current for an alternating current retards growth and sometimes proves injurious, since it furnishes a field with variable flux.

RESULTS OBTAINED IN 1920  
July 27, 1920 — *Aubervilliers Scotch Kale*

	Treated plants			Untreated plants		
	Total diameter	Diameter of the head	Weight Kg.	Total diameter	Diameter of the head	Weight Kg.
1	60	22	2 450	45	22	2 950
2	70	22	3 570	45	19	2 950
3	55	18	2 500	0	16	2 000
4	50	20	2 650	50	18	3 150
5	50	20	2 000	47	19	3 250
6	50	20	2 000	46	17	2 230
7	55	18	3 250	50	16	2 480
8	50	18	3 450	45	17	2 150
9	50	19	3 200	40	16	2 050
10	50	18	2 500	42	16	2 100
			27 970			25 310

July 27, 1920. — *Belgian black kidney beans.*

treated		non treated	
2 green plants with leaves. . . . .	1 kg. 790	2 green plants with leaves . . . . .	1 kg. 650
<i>Belgian black kidney beans gathered green.</i>			
16 plants . . . . .	3 kg. 280	16 plants . . . . .	2 kg. 420

*Lettuce.*

3 salad lettuces selected from the best . . . . .	0 kg. 700	3 salad lettuces selected from the best . . . . .	0 kg. 510
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August 4. — *Belgian black kidney beans, green.*

15 plants . . . . .	1 kg. 850	15 plants . . . . .	1 kg. 900
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August 11. — *Cabbage.*

2 plants . . . . .	6 kg. 525	2 plants . . . . .	6 kg. 450
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August 28. — "*Express*" potato.

20 plants . . . . .	18 kg.	20 plants . . . . .	20 kg.
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September 2. — "*Royales*" potato.

80 plants . . . . .	74 kg.	80 plants . . . . .	60 kg.
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September 10. — *Kidney beans*

4 plants . . . . .	15 kg. 850	4 plants . . . . .	14 kg. 100
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#### RESULTS OBTAINED IN 1921.

Treated		Not treated	
<i>Lettuce.</i>			
44 plants . . . . .	10 kg. 715	44 plants . . . . .	7 kg. 300
<i>Cos-lettuce.</i>			
9 plants . . . . .	3 kg. 200	9 plants . . . . .	2 kg.
<i>Sauterelle Scotch Kale.</i>			
20 plants . . . . .	92 kg. 450	20 plants . . . . .	76 kg. 750
<i>"Saucisse" potato.</i>			
20 plants . . . . .	14 kg. 350	20 plants . . . . .	8 kg. 750
<i>"Express" potato.</i>			
100 plants . . . . .	30 kg.	100 plants . . . . .	22 kg.

G. D.

1212 — "*Micropump*" R. Leff. — *Bulletin de la Société Nationale d'Acclimatation*, Year 69, No. 8, p. 156. Paris, Aug. 1922.

This pump which is very light and small (dimensions 0.<sup>m</sup>55, weight 15 kg.) lifts 2 cubic m. an hour to a total height of 25 m. It may be connected to a simple electric light installation by means of an ordinary plug. The "*Micropump*" may be supplemented with an automatic control worked



by a float ; the arrangement would allow the supply of water for fish breeding establishments to be renewed at varying rates of speed with the possibility also of regulating changes of level. F. D.

1213 — **A new Seeder.** — VITALI, G., in *Giornale della Domenica*, Year XXXII, No. 34, p. 277, 3 figs. Piacenza, Aug 20, 1922.

A new kind of seeder, the LONGHINI, has recently given good results both on uneven and flat ground.

It is so constructed that, in spite of its low price, small size and simple construction, it has the following advantages :

(a) regular distribution of the seed in parallel furrows, at depths which can be regulated ;

(b) even distribution of the seed in the furrows ;

(c) means of modifying the spacing of the seed rows within relatively wide limits, so that it is possible to sow cereals properly at different spacings ;

(d) means of continuing the work at the end of the field, in such a way that the rows are always equi-distant over the whole area sown ;

(e) power to vary the amount of seed sown per ha. at will ;

(f) the greatest uniformity in the depth of the furrows ;

(g) it covers the seed with the soil of the furrows. In addition all parts of the seeder are very strong, its stability is absolute and it is well adapted to sloping ground.

To attain these objects the construction of the seeder has been planned in an entirely novel manner, both in the details of construction and as a whole.

The seeder has a maximum height of about 65 cm. above the working plane ; the centre of gravity is low, giving the machine greater stability. Hopper, handles, frame, coulter holders and the frame bearing the handles together form a rigid whole. The distributors with bronze grooved cylinders for forced distribution are controlled by a differential attached to the axle of the wheels. The depth of the furrows can be regulated. The writer concludes by hoping that all these good qualities will secure the success of the machine. G. D.

## RURAL ECONOMICS.

1214 — **The Cost of manual Labour in the Production of Milk.** — RUSTON, A. G., and SETON, R. S., in *The Journal of the Ministry of Agriculture*, Vol. XXIX, No. 5, pp. 411-419, 4 figs. London, Aug. 1922.

The cost of manual labour in the production of milk may be divided into *direct* and *indirect* expenditure. The first includes the expenses of milking, feeding and upkeep of the cows, the maintenance of the cow-houses and utensils and of looking after the bull. Indirect costs include the wages of labour for the production of the foods given to the dairy cows.

According to numerous records made since 1908 by the Department of Agriculture at the University of Leeds for a number of herds, it may

be concluded that one man can on the average look after 16 cows, say 12 cows during the winter months and 18 cows in summer; that each cow consumes on the average 18 cwt. of concentrated food, 15 cwt. of hay, 15 cwt. of straw, 1 ton of roots and grazes 1 acre of pasture, and that the average direct and indirect expenses per cow amount to £136.10 a year.

*Average annual cost of upkeep per cow in 1919-1920.* — In 1919-1920 the expenditure on manual labour was about 26 % of the expense of keeping a cow. As the farmer will be unable to reduce the rate of wages of his labourers he will have to organise their work better, and to adopt methods by which manual labour will be reduced in order to effect economies.

*Alterations in the number of labourers and in the cost of manual labour employed in the production of milk.* — The writers estimate that in 1919-1920 the direct expenditure on manual labour should not have been more than 20 % of the cost of production of the milk. They refer to several registered herds in which the percentage of the cost of manual labour in the production of milk varied according to circumstances. Among the attempts made by certain farmers to reduce the cost of production, the writers specially mention the case of a dairy in which a milking machine was used. This innovation made possible an economy of  $\frac{1}{2}d$  per gallon. However the purchase of a milking machine does not show a profit except for herds of more than 40 head. In another farm ingenious arrangements were made to facilitate and diminish the need for manual labour. Owing to increased production obtained in more hygienic conditions the farmer was able to sell his milk for 5d. a gallon more than other producers, while his expenses on manual labour were not increased by more than 3  $\frac{1}{2}l$ . per gallon. The writers also mention the case of a dairy where the cows were separated in several cowhouses. This arrangement brought the cost of manual labour up to as much as 10d. per gallon of milk, while in a neighbouring dairy where all the cows were stalled in the same cowhouse the proportion of the cost of manual labour in the cost of production was 18 % less as compared with that in the preceding case. The installation of a petrol motor in two other farms allowed the cost of manual labour to be reduced by as much as 1  $\frac{1}{2}l$  per gallon of milk in one case and to decrease it by 25 % in the other compared with the cost entailed by the previous use of an old steam motor. F. S.

1215 — **Comparison between Net Costs and Profits of French Breeding in 1913, and 1921.** — DEMAUNY, in *Bulletin de la Société des Agriculteurs de France, Supplément au Bulletin d'avril 1922 Comptes rendus de l'Assemblée Générale de 1922*, part 2, pp 47-50. Paris, 1922

The writer enquires into the differences between the net costs and profits of French breeding in 1913 and 1921 by making use of the coefficients of foods and manual labour applied to three principal classes of animals.

**CATTLE.** — The price per kg. of live animals in 1914 was 0.85 fr.; it then rose slowly to 0.95 fr. in 1915; 1.16 fr. in 1916; 1.50 fr. in 1917; 1.93 fr. in 1918 and more sharply only in 1919 to 2.59 fr. to reach the maximum of 4.30 fr. in 1920. Since then a rapid fall has brought the price down to 2.24 fr. at the end of 1921.

[1214-1215]

This shows that up to 1917 breeders did not make sufficient profit to justify their efforts, and that they did not begin to make large profits until after the war in 1919 and more especially in 1920. Up to the end of 1918 prices were controlled.

The comparison between the coefficients of 1913 and 1921 is as follows:— manual labour, 4.5; straw, 2; hay, 4.5; lucerne, 5; mangolds, 4; cake, 4. With these coefficients, which show that the costs to the breeder were generally 4 times as high in 1921, the writer compares the coefficient of 3 for profits. Even during 1921 dealers who bought in February to sell again at the end of the year have suffered losses often exceeding 1000 fr. per animal.

The following are some striking comparisons:—

A calf is fattened on 1000 l of milk

In 1913, at 0.20 fr per litre, it cost 200 fr ;

In 1921, at 0.60 fr per litre, it cost 600 fr ;

or a coefficient of 3 instead of 1

The fattening of a cow takes about two and a half months

It cost —

	in 1913	in 1921
Normal ration	109 fr	288 fr
Concentrates	20 "	64 "
Manual labour	20 "	50 "
	149 fr	402 fr.

or a coefficient of over 2.5 instead of 1

For a dairy cow the estimated cost of rations, both in the stall and at pasture, works out as follows —

	in 1913	in 1921
Stall feeding, 6 months	261 fr	720 fr
Grazing, 6 months	30 "	115 "
	291 fr.	835 fr.

The cost of upkeep in 1921 is therefore almost 3 times what it was in 1913

**SHEEP.** — Coefficients of 1921 compared with those of 1913:— Manual labour, 4.5; grain, 2.5; straw, 2; hay, 3.5; sainfoin, 4; mangolds, 4; cake, 4; the average coefficient is slightly less than 4. Comparing the current rate of 1.40 fr. a kilo live weight in 1914 with that of 4 fr. in 1921, receipts barely balance expenditure.

**PIGS.** — Coefficients of 1921 compared with those of 1913:— Manual labour, 4.5; potatoes 6; bran, 4; grain, 2.3; cake, 4. For pigs the coefficient of potatoes, the food most generally used, is 6 while the value of the pig, per kg. live weight, which rose from 1.20 fr. in 1913 to 4 fr. in 1921, has only quadrupled. The breeder must therefore increase the proportion of grain and cake in the ration to avoid loss.

The writer supplements these comparative figures by noting the rise in the following coefficients which affect the necessary expenses of every breeder:—

The cost of wheelwright's work, farriery, and harness was from 4 to 5 times higher in 1921 than in 1914.

Building materials and the wages for skilled workmen such as masons, carpenters, joiners and tilers, cost 5 to 8 times as much.

Transport costs from 2 to 3 times and manure from 4 to 6 times as much though it is true that manures have recently fallen in price.

G. A. B.

1216 - **Reduction in the Values of Farm-Products.** — *Weather Crops and Markets*, Vol 1, No 22, p 465. Washington, D C, June 3, 1922

The value of dairy and poultry-yard produce has fallen much less rapidly than the value of other farm-products. Reduction began in 1920 and continued during 1921. The index figures for prices for 1920 and 1921, reckoning the 1919 figures as equivalent to 100, are given in the annexed table and have been calculated by the "Bureau of Markets and Crop Estimates". These figures show that when in 1921 the prices of cereals, forage and stock showed a 50 % fall as compared with the prices for 1919, the prices for dairy and poultry-yard produce fell 25 % only. The greatest fall was in the price of wool, the figure for 1921 being only about 33  $\frac{1}{3}$  % of that recorded for 1919.

The total value of the dairy products for 1919 was estimated at 2 410 000 000 dollars, representing 45 % of the total value of the animal products. In comparison with 1919 this figure shows a decrease as regards

*Index numbers of farm products, 1919-1921.*

Product	(1919 = 100) 1919	1920	1921
Crops . . . . .	100	102	47
Stock . . . . .	100	85	54
<i>Crops and Stock. . .</i>	<b>100</b>	<b>94</b>	<b>50</b>
Cattle . . . . .	100	87	57
Lambs . . . . .	100	90	55
Sheep . . . . .	100	88	48
Wool . . . . .	100	75	33
Pigs . . . . .	100	80	48
Milch Cows . . . . .	100	97	64
Calves . . . . .	100	93	62
Milk Yield . . . . .	100	103	76
Butter . . . . .	100	108	64
Poultry . . . . .	100	106	87
Eggs . . . . .	100	107	71

total value and an increase as regards the percentage of the total of animal products. The value in 1919 was 2 970 000 000 dollars, *i. e.* 37 % of the total value.

The value of the poultry-yard produce fell from 1 100 000 000 dollars in 1919 to 943 000 000 dollars in 1921, while these products represented, in 1919 and 1921 respectively, 13 % and 78 % of the total animal products.

A. de B.

## AGRICULTURAL INDUSTRIES.

1287 - **Presence of Arsenic in Grapes, Musts and Wines due to the Use of Insecticides**(1). — KRUG (Speyer), in *Wern und Rebe*, Year 4, No. 4, pp. 179 181. Mainz, Aug. 1, 1922

INDUSTRIES  
RELATING  
TO PLANT  
PRODUCTS

For several years the German Health Bureau requested the oenological laboratories to search musts and wines for arsenic and lead from the insecticides used against cochylis (*Cochylis ambiguella*).

The year 1921 was very favourable for such work because, as there had been very little rain, the insecticides were not washed off the grapes. It was therefore probable that the poisonous matter remained on the grapes to a greater extent than usual and passed into the musts and wines.

The writer determined, according to the methods of the Health Bureau, the arsenic content of musts and wines made from grapes treated with STURM'S remedy or with uranium green.

He obtained the following results :—

in 1 kg. of grapes mgm 0.13 and 0.73 of arsenic  
in 1 l. of must mgm 0.16, 0.93 and 1.28 of arsenic  
in 1 l. of wine mgm. 0.2 and 0.2 of arsenic.

Arsenic is therefore found in grapes, musts and in wine; but according to pharmaceutical data, the quantities are so small that they need cause no apprehension from a hygienic or sanitary point of view, even to persons who may consume large quantities of grapes treated with insecticides or of their products. STURM'S insecticide especially, which is the most generally used and the most effective remedy, does not have any appreciable trace of arsenic. The figures given above show that a large proportion of the arsenic disappears during fermentation. Naturally, when using arsenical substances all possible precautions should be taken. L. V.

1218 - **Disappearance of free Sulphurous Acid in preserved Apple Juice.** — WARCOLLIER and LE MOAL, in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VIII, No. 9, pp. 325-331. Paris, March 1, 1922.

To obtain sweet cider in the months of April and May, at which time it cannot be obtained naturally, "dry" cider is sweetened with sugar, or preferably with apple juice preserved by means of sulphurous acid.

The writers have ascertained that the quantity of free sulphurous acid

(1) See R. 1916, Nos. 795 and 1319. (Ed.)

decreases with the duration of preservation ; this phenomenon is due to the fact that when the apple juice was prepared a certain number of rotten apples were used. The writers have shown that the oxidating diastases of rotten apples caused oxidation of the pectin and of the sugars contained in the apple juice, and that these constituents are thus transformed into aldehyde and ketone compounds which absorb a large quantity of sulphurous acid. The acid is combined with these compounds and thus loses its antiseptic properties.

The remedy consists in using only perfectly sound apples in the preparation of apple juice for preservation. F. D.

1219 — **Maraschino prepared with pure Blastomycetes.** — SCHWEIZER, K., and FISCHLIN, H. (Laboratorium des Eidgenössischen Gesundheitsamt, Berne) in *Mitteilungen a d Geb Lebensmitteluntersuchung u Hygiene*, Vol XII, No 4, pp 217-222 Berne, 1922

Cherry pulp, fermented and distilled, gives the cherry liqueur known under the name of Maraschino. The cherries intended for such use are placed in barrels and brought to the distillery, where they ordinarily undergo spontaneous fermentation. Pure cultures, generally isolated from wine must, have been very little used. SCHWEIZER recently isolated in cherry must 7 species of blastomycetes and used them in the production of maraschino with the cooperation of a distillery. He determined for each of these species their production of alcohol and, for the most active, their production of acids, and ethers ; in addition, he kept account of the aroma under different conditions, such as with sterilised juice and with juice not sterilised ; he then proceeded with distillation.

Four species gave good results — *Saccharomyces Cerasi I*, *S. Cerasi II*, *S. Chodati* and *S. Fischlini* ; one species, *S. Zopffii* produced a bad alcohol ; two others *S. carlsbergensis* var. *Cerasi* and *S. Guilhaumonii* were excluded from the experiments after a preliminary test in which they produced alcohol inferior to that of the others. L. V.

1220 — **The Sugar Industry in Russia before and after the War.** — DADE, in *La Reconstruction*, No 3, pp. 13-14 Berlin, May 27, 1922.

The growth of sugar beet in Europe has opened unexpected fields to the agriculturist. From an economic standpoint it has given an industrial complexion to agricultural enterprise and has improved the yield of the soil in a manner hitherto not thought to be possible. The mellowing of the soil by the deep roots of the beet, manuring and other favourable results inherent in this kind of cultivation have increased not only the yield of the beet itself, but also that of other crops grown afterwards on the same soil, as for instance that of wheat. From the social standpoint this cultivation has mobilised the agricultural labourer. The cultivation of beet had expanded to such an extent in Europe during the 20 years before the war that its production almost equalled that of sugar cane. Thus in 1912-13 the world's production of beet sugar reached 9 000 000 t. and that of cane sugar 9 300 000, or 18 300 000 t. total production. The production of beet sugar was therefore as much as 49 % of the whole sugar production.

Probably no branch of agriculture was so hardly tried by the war. The restrictive measures taken by the State, the lack of artificial manures and labour caused the cultivation of beet to decrease by more than half its previous production. At the time when the production of cane sugar increased to almost 12 000 000 t. that of beet sugar fell to 3 500 000 t. total or, scarcely a quarter of the production in 1919-1920. Before the war Germany headed the European production with 27 000 000 t. of sugar. Russia, with 19 000 000 t. came second, and had exceeded, shortly before the war, the Austro-Hungarian sugar production. The lowest yield was that of the crop of 1919-20, when Germany produced only 720 000 t. that is to say a quarter, and Russia only 350 000, or a sixth of their pre-war production. In Germany it recovered in 1921-22 to about 14 000 000 t. or 50 % of the old production, but in Russia it is still fairly low. Apart from Polish soils it is mainly the "black soil regions", especially in the Provinces of Kiew, Podolia, Volhinia, Tschernigow and Poltava, which are particularly suitable for sugar beet cultivation. In these Provinces sugar beet cultivation, under the action of the "Normirowka" Syndicate, had reached a development which made these Provinces the greatest competitors among producing countries of Western Europe in the world's market. These Provinces having combined in 1902, at the time of the Brussels convention and having paralysed Russian export, the Russian Government endeavoured to preserve its sugar industry by legislative measures. However the home consumption of the country could not be increased quickly enough and it was not easy to find new markets in the East to compensate for the loss of the Western markets. Thus overproduction ceased to increase. The Russian Government was then obliged in turn to join in the Brussels convention in 1907. In 1912 the convention was renewed on the condition that its renewal should last up to 1918, and that Russia should have the right of export to the adherent countries of Western Europe, over and above her annual quota of 200 000 t, an excess of 150 000 t for 1911-12 and a surplus of 50 000 t. for the following years.

When war broke out, there were in Russia about 270 sugar factories, the area under beet crops was about 700 000 ha. and the production was over 100 000 000 pouds (about 1 630 000 t.) At the present time only one third of these sugar factories are working, and the area under cultivation is not more than 40 % of the former area. It is not only the area under cultivation which has enormously decreased, but also the production of sugar. According to reliable information, beet growing has not, it is true, suffered so greatly from the war and the revolution as other branches of agriculture, because the peasants have understood its great importance and have managed more or less to preserve it from destruction. In the sugar industry also, the tendency was to pass on to the small rural proprietor an increasingly important part of the beet crop which formerly belonged exclusively to large proprietors. It should also be added that the labour question does not present the same difficulties in Russia as elsewhere, for work is generally done with the help of the peasants of the neighbourhood.

An attempt is now being made in the Ukraine to restore the beet crop

to its pre-war level and to procure seed in Germany so as to be able in three years to grow the necessary plants. Some experts even think that, if the situation remains quiet, in three to five years at latest, the growing of sugar beet will to a large extent recover in southern Russia.

G. A. B.

1221 - **The Distillation of Stump-Wood and Logging Waste of Western Yellow-Pine.** — DUNK, M. G. (Assistant Chemist, Leather and Paper Laboratory, Bureau of Chemistry), SHATTUCK, C. H. (Professor of Forestry), and MARSHALL, W. D. (Research Fellow, Forestry Department, University of Idaho), in *United States Department of Agriculture, Bulletin No. 1003*. Washington, D. C., Dec. 1921.

Western yellow pine (*Pinus ponderosa*) is the most widely distributed of the western commercial softwoods. The Forest Service estimates the amount of standing timber of this species to be approximately 335 000 000 000 board feet, or more than that of any other species except Douglas fir. The reported cut for this species for 1917 was 1 862 914 815 board feet. This represents an area of more than 350 000 acres of land annually cleared and left covered with stumps after logging operations. About one third of this is within the national forests and is generally of little value for agriculture because of the roughness of the land. Much of the remaining two-thirds however is valuable for crops.

Removing the stumps is arduous and costly, and so far they have been considered to be worthless after removal. Any process which may serve to reduce the cost of clearing the land or lead to the discovery of a profitable use for the stumps is therefore worthy of careful consideration. Observations on the methods of utilizing the more resinous portions of the yellow pine of the South (*P. palustris*) in the manufacture of wood-distillation products suggested the possibility that the western species might serve the same purpose, as these trees, especially the stumps, are often quite resinous.

It is well known that western yellow pine was used in California as a profitable source of turpentine during the Civil War. In speaking of turpentine obtained from western yellow pine, SCHORGER says: "There is no reason to suppose that both the California and the Arizona oils will not serve the purposes for which ordinary turpentine is commonly used." According to BETTS nearly as much turpentine and resin was obtained from western yellow pine as from the pines of the Southeast. WENZEL states that the odour, specific gravity and boiling point of oleoresin from *Pinus ponderosa* correspond with those of the common oil of turpentine. It is therefore reasonable to suppose that turpentine operations in the large tracts of virgin pine timber in the West will be undertaken within a few years, because of the rapid cutting of the yellow pine of the South. For convenience the chief areas of western yellow pine may be grouped as follows: 1) Arizona and New Mexico; 2) California; 3) Oregon and Washington; 4) Idaho, Montana, and Utah; 5) Colorado, South Dakota and Wyoming.

Not all of the stumps are sufficiently resinous for profitable distillation under present conditions. If the areas are not agricultural in character,



they should be reafforested. In this case the land clearing problem is not so important, although the stumps should be utilized, if it is economically possible to do so. For the entire area of western yellow pine land, the average volume of stumpwood is 2.5 cords an acre, and probably half of this land carries double this amount of stumpwood. In general the stumps of western yellow pine are not as uniformly rich in resin as those of the longleaf yellow pine in the South Atlantic and Gulf states. The only wastes from western yellow-pine logging suitable for profitable distillation on a commercial scale are those resinous stumps which contain at least 50 per cent or more of resinous heartwood, and the resinous heartwood of stumps, dead, felled wood, and limbs from which the sapwood has rotted away.

It is impossible to classify western stumps merely by a superficial examination of the quantity of resinous exudation on the face of the stumps. "Rich" stumps, containing not less than 60 per cent of very resinous heartwood, probably can be profitably distilled in a commercial plant where the stand of such stumps is dense enough to keep a plant supplied for a number of years.

Owing to the fact that there is a well-developed market in the west for crude pine-wood oils for use in the flotation concentration of ores, and also to the small volume of "rich" wood obtainable within hauling distance, it is probable that single retort plants, which can be dismantled and moved when necessary are the most suitable for wood distillation in that section of the country, especially in regions remote from the railroad. Such plants might be owned and operated jointly by a number of settlers.

The resined turpentine, from western yellow-pine stumpwood, consisting mostly of "beta-pinene" and "limonene", has higher boiling-point limits than similar turpentine from southern yellow-pine, and dries much more slowly. For this reason paints and varnishes thinned with the turpentine take longer to dry than the same paints and varnishes thinned with turpentine made from the longleaf yellow pine of the South.

The solvent power of this turpentine is not less than that of wood turpentine from longleaf yellow pine made and refined by the same process. It is suitable for many if not all of the purposes for which wood turpentine can be employed.

The refined pine oil and the crude oils obtained by distilling western yellow pine are valuable for ore recovery by the flotation process. This is probably the most profitable use to which these products can be put. The crude light and heavy oils have germicidal properties, approximately half as great as those of phenol, for which reason they are useful for shingle stains, wood preservatives, vermin killers, and disinfectants.

The pyroligneous acid or "acid liquor" contains approximately one fourth the amount of acetic acid, methyl alcohol, and acetone ordinarily recovered from hardwood acid liquor, and is heavily charged with dissolved tarry matter, resembling in all respects the pyroligneous acid obtained in distilling southern yellow-pine wood. At the usual prices the recovery of these materials at a profit is hardly possible by present

methods. A simple method has been devised for the commercial refining of crude wood turpentine, which yields a superior product. A. d. B.

INDUSTRIES  
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1222 - **Relationship between the Concentration of the Hydrogen Ion and the Number of Bacteria in Milk** (1). — SCHULTZ, E. W., MARX, A. and BEAVER, H. J. (Stanford University, California), in *Journal of Dairy Science*, Vol. V, No. 4, p. 383-387. Baltimore, July 1922.

The bacterial numeration of milk by the plate method requires several manipulations and does not allow the result to be known until 48 hours later; the determination of the concentration of the hydrogen ion made by means of a colorimetric method, on the other hand, only requires a few minutes and is still quicker if it is done with the WENDT electric apparatus.

The writers used this apparatus in a long series of comparative tests with the plate method.

The results showed a satisfactory agreement between the two methods: the quality of milk can therefore be estimated with sufficient precision by measuring the concentration of the hydrogen ion. Owing to the facility and rapidity of this process, it deserves to be widely used in the dairy industry and by consumers, especially in cases where it is important to know the quality of milk before it is used e. g. in hospitals, etc.

Milk shortly after milking has ordinarily  $\text{pH} = 6.7$  to  $6.8$ . At  $\text{pH} = 6.5$ , the number of bacteria exceeds the limit generally allowed. Milk, in which the acidity is scarcely sensible to taste has about  $\text{pH} = 6$ .

F. D.

1223 - **The Accuracy of Weinzirl's Test for Determining the Contamination of Milk by Excrement.** — HUDSON, J. R., and LANNER, F. W. (Department of Bacteriology, University of Illinois, Urbana), in *Journal of Dairy Science*, Vol. V, No. 4, pp. 377-382, 4 figs. Baltimore, July 1922.

Among the different methods recently suggested for the detection of contaminated milk, is included that of J. WEINZIRL and M. V. VEL-DEE (*American Journal of Public Health*, Vol. V, No. 9, pp. 862-866, 1915), which is practiced in the following manner. gs. 0.5 — 1 cubic cm. of melted paraffin wax is poured into a test tube with a diameter of 15 mm. which is stopped with cotton wool and sterilised in dry or moist heat. 3 cubic cm. of the milk to be examined is run into the same tube by means of a sterilised pipette; it is placed in an ARNOLD steriliser and is heated to  $80^{\circ}\text{C}$  for 10-15 minutes. This treatment causes the paraffin wax to melt and rise to the surface where it hardens on cooling and forms a seal which only allows the development of anaerobic microbes. The heat also drives off the oxygen absorbed by the milk and thus renders anaerobiosis more complete. All the micro-organisms developed are destroyed by the heat; only the spores remain. The tubes are then incubated for 3 days, at  $37^{\circ}\text{C}$ . If there are any anaerobic micro-organisms, gas is formed which raises the stopper of paraffin wax in

(1) See *R* Dec 1921, No. 1280 (Ed)

the tube. Two positive tubes out of five indicate excessive contamination. To test the degree of accuracy of this method the writers applied it to about a hundred samples of milk. The results obtained, comparatively with the count on the plates (FROST'S method) and with the examination of the sediment (WIZARD'S method), show that the WEINZIRL method cannot be admitted as an accurate determination of contamination of milk by farmyard manure. There is no relation between the amount of impurities on the one hand and the number of micro-organisms and the results of WEINZIRL'S test on the other hand.

These results and conclusions confirm those of AYERS and CLEM-MER (1). F. D.

1224 - **Contamination of Milk by defective Corking of Bottles.** — JACKLEY, J. G. (State Department of Agriculture, Sacramento, California), in *Journal of Dairy Science*, Vol. I, No. 4, pp. 406-411, 2 figs. Baltimore, July 1922.

Milk which is perfectly wholesome at the time of bottling may become, especially during epidemics, a means of infection, owing to corking the bottles with corks which are pushed into the necks of the bottles while leaving the edges uncovered. Wiping the top of the neck with a cloth, and even washing it with soap and hot water, so as to remove all visible trace of dirt, are of very little use as means of disinfection; the writer has proved this by pressing the tops of the necks of bottles cleaned in this way on plates of agar-agar. On the other hand the use of disinfectants is neither practical nor to be recommended. It would be better to close the bottles with capsules covering the edges of the tops of their necks; but as the cost of capsules is rather high and much more than that of ordinary corks, it is not always possible in practice to use them. The writer has therefore tried sterilising the edges or the neck over a gas flame by turning the bottle quickly while counting from 1 to 5 at least and up to 8 at most. The flame should only lightly touch the edges to avoid splitting the glass. This method is quite effective, and is recommended by the writer. F. D.

1225 - **The Milking Machine and the Hygienic Qualities of Milk.** — BREW, J. D. (Cornell University, Ithaca, New York) in *The Journal of Dairy Science*, Vol. V, No. 4, pp. 412-420, 2 diagr. Baltimore, July 1922.

The "New York City Board of Health" has laid down that first quality milk, that is to say milk sold raw for direct consumption, must not contain more than 30 000 micro-organisms (colonies) per cubic centimetre; milk which is sterilised must not contain more than 100 000 if of second quality or more than 300 000 if it is third quality. Beyond these limits milk is considered unfit for direct consumption. The three qualities above referred to are designated respectively by the letters A, B, C.

To encourage the production of hygienic milk the sellers pay the producers a premium on first quality milk and a much smaller one on

(1) See R. Dec. 1921, No. 1287. (Ed.)

second quality milk. It is therefore of great interest to the producer to know the rules to be followed to produce hygienic milk.

In March 1921 the Dairy Department of the New York State College of Agriculture, undertook a propaganda and instruction campaign for the production of hygienic milk. The work was based on bacteriological study, by means of the direct microscopic method, of milk delivered by every producer to retailers on 2 or 3 successive days; the results so obtained were explained and discussed at a meeting of producers to whom previous notice was given. The examination of milk carried out in this way from March to September has enabled important information to be collected on the subject of the principal bacterial factors which affect the number of bacteria in milk. Observations made in classifying 3243 samples of milk delivered by 1104 producers have led to the conclusion that the most common causes of a large number of bacteria in milk when it is delivered to the seller in town are: — 1) want of rapid and effective chilling of the milk immediately after milking; 2) high contamination of the milk by jugs or other dairy utensils which were not sufficiently sterilised by means of a jet of steam, boiling water or by drying in a current of hot air immediately after washing; 3) heavy contamination by dirty milking machines.

The comparative examination of milk supplied by 790 producers, 635 of whom milked by machine and 155 by hand, has enabled it to be ascertained that:— before the meeting of producers 31.6 % of those who used milking machines supplied A quality milk, 12.9 % milk of B quality and 55.5 % C quality milk; after the meeting, 54.0 — 18.5 — 27.5 respectively; those who milked by hand: — before the meeting A quality milk 70.7 — B quality 9.3 — C quality 20.0 %; after the meeting, 84.6 — 5.9 — 9.5 % respectively.

These results, from a hygienic point of view, are not in favour of milking machines; on the other hand they indicate the possibility of improving present conditions, which is much to be desired, since, owing to the high cost of manual labour, milking machines are becoming more and more common.

One of the main reasons for insufficient cleaning of milking machines is that the manufacturing firms, in the instructions for the use of their machines, do not sufficiently emphasize the necessity for careful cleaning. To eliminate these drawbacks the representatives of various factories met at a conference at which the question was explained to them and they will try to find a solution.

F. D.

1226 — **The Foaming of Cream.** — BABCOCK, C. J. (Dairy Division, Bureau of Animal Industry, U. S. Department of Agriculture) in *U. S. Department of Agriculture, Bulletin* No. 1075, 22 pp., 14 fig. Washington, D. C., July, 13 1922.

Owing to the increasing use of whipped cream as human food and the small amount of knowledge that we have on the subject of the factors which determine the aptitude of cream to foam, the writer undertook an experimental investigation. To measure the consistency of whipped

cream, he invented a very simple apparatus, composed of a very small balance bearing a counterpoise at the end of one of its arms, and provided at the end of the other arm with a small rod ending in a disk; the counterpoise is moved until the disk penetrates into the cream, and the graduation on which the counterpoise happens to be indicates, approximately, the pressure in grammes per square inch. The results obtained may be summed up as follows:—

Non-pasteurised cream whips better than pasteurised, homogenised or pasteurised-homogenised cream. Pasteurisation slightly reduces the aptitude of the cream to foam especially when it contains less than 23 % of fats. Homogenisation reduces very much the aptitude of cream to foam; the greater the pressure required to homogenise the cream the more the aptitude of the cream to foam is reduced. Homogenisation combined with pasteurisation renders the cream practically useless for whipping. The aptitude of cream to foam, whether poor or rich in fats, pasteurised or not, homogenised or pasteurised-homogenised, increases with the age of the cream. But the age of cream necessary for successful whipping varies with the quality and the fat content of the cream. In any case the most rapid changes take place during the first 48 hours, and after about 72 hours the greatest yield of whipped cream per weight unit of cream is obtained.

The aptitude of cream to foam improves with an increase in the fat contents up to 30 %. In higher percentages the quality or consistency of the whipped cream does not sensibly improve but the consistency lasts longer and the time required for whipping decreases.

Temperature is an important factor in the whipping of cream. To get good results, the temperature of the cream should not exceed 7° C.

Increased acidity by adding lactic acid or by natural acidification does not affect the aptitude of cream to foam so long as the acidity does not exceed 0.3 %; beyond that degree of acidity the cream has an acid taste.

"Viscogen" suitably used increases the aptitude of cream to foam and does not affect its taste. "Viscogen" (BABCOCK and RUSSELL, *The Restoration of Consistency of Pasteurized Cream, Wisconsin Agric. Exp. Station, Bulletin No. 54*) is prepared in the following manner:— 2.5 parts by weight of sugar are dissolved in 5 parts of water; 1 part of quick-lime is dissolved gradually in 3 parts of sugar and water; the liquid is strained through a sieve; the filtrate is stirred frequently and, 2 or 3 hours later it is allowed to settle until the clear liquid at the top can be siphoned off. It must be used with discretion, that is to say in a quantity insufficient to render the cream alkaline.

Sugar added in sufficient quantity to thoroughly sweeten the cream, whether it is added before or after whipping, decreases its aptitude to foam; the smaller the amount added the less its effect. The addition of aromatic essences has no effect either on the quality or preservation of the whipped cream. The most important factors which determine the consistency are temperature, the quality of the cream and its fat content.

Cream powder will not whip. Condensed milk can be made to foam

but the whipped cream so obtained disintegrates immediately ; such milk cannot therefore be used for the purpose. F. D.

**1227 - Calculation of the Quantity of Yeasts and Moulds and their Relationship to the Pasteurisation of Cream for making Butter.** — STIRITZ, B A (University of Illinois, Urbana) in *Journal of Dairy Science*, Vol V, No. 4, pp 362-371, bibliography of 10 publications Baltimore, July 1922

The writer's experiments had a double object :— 1) to discover whether the calculation of the quantity of yeasts and moulds present in butter could furnish useful information on the subject of the efficiency of pasteurisation and on the manipulation of the cream during butter making ; 2) to determine the causes of contamination of butter which, in spite of the use of pasteurized cream, suffers from the presence of yeasts and moulds.

From the results obtained the writer concludes that : — 1) The calculation of the yeasts and moulds in butter cannot furnish any certain indication of the effectiveness of pasteurisation. However, if 30 is taken as the maximum number of colonies of yeasts and moulds per cubic centimeter of butter, it may be considered as an indication of the care taken in making the butter ; 2) This calculation cannot indicate whether the butter was made with pasteurized cream or not , 3) The churn may be one of the principal sources of contamination of the cream after pasteurisation , 4) The cream may be contaminated by the use of a " starter " to assist fermentation, but that source of yeasts and moulds has scarcely any effect on the final calculation, unless a " starter " of very bad quality is used. F. D.

**1228 - Common Defects in Butter and how to Avoid Them.** — HAMILTON, D, in *Bulletin* No. 427, *Department of Agriculture, Salisbury, Rhodesia*, 11 pp. Salisbury, Aug 1922

The most common defects in butter, so far as the flavour is concerned, are as follows :— insipidity — flavour of burnt meat — flavour of fish — flavour of cheese — flavour of yeast — bitterness — mouldiness — rancidity. The writer (Dairy Expert, Specialist for Dairy and milk food industries to the Department of Agriculture of Rhodesia), describes them in detail, examines their causes and shows how to avoid them , finally, he gives the following summary of the precautions to be taken in making butter.

The place where butter is made should be cool, hygienic, clean ; the walls should be frequently whitewashed. The receptacles intended for holding cream should only be used for that purpose and should be suitable. The cows should get succulent green food, even in winter. The cream should be kept in as cool a place as possible in summer and at a temperature of 15° or 16° C in winter , very low temperatures cause the development of a bitter taste in the cream. Churning should be done at least every three days in summer and every four days in winter.

Churning should not take too long, as in that case the butter loses its consistency. The butter should be washed twice while still granular,

with water as cold as possible. Butter should not be kept in a damp dark place. Butter should not be worked up to such a degree as to make it soft. Granular butter should be turned out on the working up table, covered with damp muslin and well drained. If the butter is too much worked up, it has the texture of lard. For salting, use a saturated solution of salt; this hardens the granules of butter and helps to give a good texture. If salt is used in solid form it must be very pure, thoroughly pounded and evenly distributed. The pats of butter should be nicely shaped and wrapped in good butter-paper. Boxes for packing butter should be divided into compartments, each able to contain half a kilogramme. It is preferable to use a shallow box with a wide bottom holding 2 layers of pats, rather than a box with a narrower bottom containing 5 or 6 layers.

Regarding the causes of defects in butter, the writer explains them in the following manner:—

*Insipidity.* — This is one of the most common defects. It is due to various causes, but mainly to lack of green forage, to preservation of the cream, to too low a temperature while ripening and to excessive washing of granular butter.

*Flavour of fat.* — This flavour is ordinarily due to excessive ripening of the cream.

*Flavour of cheese.* — Is due to the decomposition of proteins in the butter-milk left in the butter owing to insufficient washing.

*Flavour of yeast.* — Due to keeping the cream too long before churning, or to insufficient cleaning of the cream separator. To avoid it, the cream should be refrigerated as soon as it is collected and should be quite clean.

*Bitterness.* — This has often been noticed during the dry season when the cows are obliged to eat tough grass, but the most frequent cause is the presence of impurities in the salt.

*Mouldiness.* — Is due to the growth of mould in the cream; to avoid it the receptacles should be thoroughly cleaned, and the cream should be covered with muslin while being kept and when sent to be churned.

*Rancidity.* — Is due to being kept at insufficiently low temperatures; it occurs especially in defective butter. Well made butter keeps very well, as is proved by an experiment made in New Zealand. Some butter made from pasteurized cream, well churned and washed, was sent to London and kept there in a refrigerator for 10 years; at the end of that time it was still perfectly sound. F. D.

1229 — **Specific Gravity of the Serum of diluted Butter Milk.** — LANTERWALD, F. and SINGER, J. (Laboratorium der Milchwirtschaftlichen Anstalt zu Greifswald) *Molkerzeitung*, Year 36, No. 63, pp. 1427-1428. Hildesheim, Aug. 22 and 25, 1922.

This work was undertaken with the object of compiling a table to show, against the specific gravity of the serum of butter-milk, the quantity of water which had been added to it.

The specific gravity of the serum of undiluted butter-milk varies between 1.026 and 1.028 at 15° C. 1.026, therefore is taken as the minimum

specific gravity and the quantity of water added is deduced by calculation from the ascertained specific gravity. The writers have calculated and give in the table specific gravities for dilutions with water in quantities increasing by 0.4 or 0.5 % from 4 to 104.7 %.

They next compared the figures thus obtained with those given by serum diluted with different percentages of water and found that the figures of the table exceeded those obtained by actual measurements by very small quantities; these differences have no practical disadvantage and are, moreover, fully compensated for by the fact that 1.026 is taken as the specific gravity of the serum of buttermilk whereas it is really on the average 1.028.

F. D.

PRESERVATION,  
PACKING,  
TRANSPORT  
AND TRADE  
IN  
AGRICULTURAL  
PRODUCTS

1230 — **The Production of Sauerkraut.** — I. BRUNKOW, O. R., PETERSON, W. H., and FRED, E. B. (Departments of Agricultural Chemistry and Agricultural Bacteriology, University of Wisconsin, Madison), The influence of certain factors upon the chemical composition of Sauerkraut, in *The Journal of the American Chemical Society*, Vol. 43, No. 10, pp. 1244-1255, fig. 1. Easton, Pa., Oct. 1921. — II. FRED, E. B., and PETERSON, W. H. (*Ibidem*), The Production of Pink Sauerkraut by Yeasts, in *Journal of Bacteriology*, Vol. 7, No. 2, pp. 257-269, bibliography of 10 publications. Baltimore, March 1922.

I. — The production of sauerkraut is an example of the economic value of certain fermentations in the preservation of food. It is a case of an acid fermentation, similar to the fermentations found in ensilage, in certain milk foods and in certain dressed-pork products. It develops spontaneously: the bacterial flora which cause it are derived from several micro-organisms, certain of which are undesirable. The lactic acid bacteria tend to predominate, but other micro-organisms capable of giving disagreeable flavours, aromas and appearances may also develop. To make good sauerkraut is therefore more or less a matter of chance; this may be avoided probably by inoculation with selected bacteria and thus a better and more uniform product may be obtained.

The fermentation of sauerkraut has only somewhat recently been the object of experiment. In 1891, REICHARDT made some chemical analyses of it; in 1897, CONRAD undertook the first research on the bacterial flora; he isolated two blastomycetes and a *Bacterium brassicae acidae* which he considered to be the principal agent of fermentation; in a complete chemical analysis he identified formic, acetic, butyric and lactic acids, ethyl alcohol, methane, hydrogen, and carbonic acid; neither acetone nor thio-alcohol were found. Other researches followed, among them those of WEHMER, who isolated a *Bacterium brassicae* and those of GRUBER, who isolated a *Pseudomonias brassicae acidae*. In 1917, HENNEBERG made the first experiments in inoculation, after a most careful bacteriological examination, which led him to isolate 7 lactic acid bacilli, 2 colibacilli, 1 of acetic acid, 8 blastomycetes and 5 hyphomycetes and to consider the types of *Bacterium lactis acidii*, a *Bacillus cucumeris fermentati*, a group similar to that of *Bacterium brassicae* of WEHMER and *Saccharomyces panis fermentati* as more important. More recently, NELSON and BECK



have taken up the chemical side of the question ; lastly L. FÈVRE has renewed the inoculation experiments with pure bacterial cultures and has shown the importance of the influence of temperature on results.

The writers made 61 laboratory experiments, in 6 series, with 2 controls for each. In each experiment they used generally 1500 gm. of cabbage well chopped and mixed thoroughly with salt. The whole was placed in glass percolators of 2 l. capacity, closed at the bottom with corks. Through the cork passed a glass tube attached to a rubber tube closed by a clip, for taking samples of the brine, which was filtered through glass wool ; the tops of the percolators were covered with disks pressed down with weights of 1 kg. The inoculations were made with pure 48 hour bacterial cultures and 50 cubic cm. of the culture were taken for each experiment ; to the controls, on the other hand, distilled water was added. The results were invariably good. The cultures used may be grouped under three types : —

1) *Leptobacillus pento-aceticus*, essentially a producer of acids, ferments many sugars ; a similar type, which also causes fermentation of pentoses, gave sauerkraut of good quality, but favoured the development of blastomycetes, which produced a red pigment ;

2) *Bacillus bulgaricus*, " yoghourt " ;

3) *Bacillus lactis acidi* ; germs of this type invariably gave the best results, that is to say, a satisfactory appearance, a sweet aroma and flavour ; a good texture : they produce less acids than the preceding types.

Blastomycetes ordinarily have an injurious effect ; many give a disagreeable taste, and produce a red pigment even when cultivated in agar-agar ; the writers found them in quantities in sauerkraut of a dark colour which was on sale in the market.

The inoculated micro-organisms were always the most numerous ; the number of germs also varied widely, ranging from 500 000 to 91 000 000 per cubic cm.

The writers made numerous accurate chemical analyses. The following were the principal substances identified :— of volatile acids, acetic acid ; of non-volatile acids, lactic acid ; of the alcohols, ethyl alcohol. Mannite is produced by bacteria which decompose levulose and reduce it partly to mannite, which may subsequently be destroyed. After extraction with boiling absolute alcohol, the writers found, in one case, 0.27 % of mannite ; they think that previous estimations were exaggerated, as the total amount of sugar from which the other ternary products of fermentation are derived does not exceed 4 % in cabbage.

The writers attribute much importance to the amount of acidity. *Leptobacillus pentoaceticus* and *Bacillus lactis acidi* produced in the first 4 days a greater increase of acidity than that noticed in the controls ; then a slighter increase up to the 18th day ; then again, a greater increase ; the increase of acidity ordinarily ceases after the 25th day. These determinations were made with material from the lower layers ; no appreciable difference in acidity was noticed during the first 4 days between the upper and lower layers after which the increase in acidity became more pro-

nounced ; finally acidity was reduced under the action of a *Mycoderma* which oxidises the acids : in one case the development of this *Mycoderma* was anticipated.

The quantity of salt ordinarily added to the chopped cabbage was from 2 to 2.5 %. When no salt whatever was added the sauerkraut got a disagreeable smell, taste and appearance, caused both spontaneously and by inoculation with *Leptobacillus*, volatile acids and alcohol were formed and butyric acid was recognised by its odour. With 3 to 3.5 % of salt the odour of the sauerkraut was satisfactory, but the texture was tough.

Experiments were also made on a large scale on two barrels of sauerkraut supplied by a commercial firm, one being inoculated and the other not. The results of inoculation are not sufficiently definite for the method to be recommended commercially and further experiments\* are required.

II. — It is known that sauerkraut is the result of spontaneous fermentation ; cabbages are cut up into thin slices ; salt is added and the whole is placed in a vat and compressed ; after a few hours, fermentation sets up, which rapidly converts the sugars in the cabbage into lactic acid, acetic acid, alcohol and other products. Normal sauerkraut has an acid reaction and an agreeable odour ; the cabbage loses its adhesiveness, but preserves its texture and becomes slightly transparent. If the sauerkraut has a strong smell and a flabby texture, it is of bad quality. Several species of micro-organisms take part in the fermentation, but the lactic acid bacteria are the most important.

Recently some firms who sell sauerkraut have found difficulty in making sure of its quality. One of the most frequent defects is the production of sauerkraut coloured red-pink or rose-salmon ; although edible it is little liked. The question is worth careful examination as the production of sauerkraut in many countries is considerable : for example 165 000 000 kg. of sauerkraut are produced annually in the State of Wisconsin and to that quantity must be added the small but numerous lots made for home use. Experiments regarding the cause of pink sauerkraut have been made :— BUTJAGIN, WEHMER and a number of other writers have tried to find germs which cause the pink pigment and the conditions in which the production of this pigment takes place. The presence of saccharomycetes and torulae was detected (1).

These germs produce a colourless chromogen which the oxygen in the air transforms into pigment.

A comparison of normal sauerkraut and pink sauerkraut shows that there are no appreciable chemical differences between them, but that the latter is much richer in micro-organisms. Torulae abound in all sauerkraut ; but the pink pigment is only produced under certain conditions which the writers have been able to ascertain experimentally by causing cabbage to

(1) The Saccharomycetes or blastomycetes sporulate by imperfect asci, for which reason BEEFELD groups them in a sub-class called hemi-asci ; torulaceae differ from them in being simpler micro-organisms which do not produce ascospores. (Ed.).

ferment in glass percolators and by varying the form of the experiment. They have concluded from these experiments that one of the most important factors is the quantity of salt: if it reaches or exceeds 3.2 % the production of pigment is much favoured. Temperature is another factor: when fermentation is developed at 20° C or above, pigmentation is produced easily. Pinksauerkraut is formed with certainty by combining these two conditions, namely, abundant salting and high temperature. Acidity is another factor: if lactic or acetic acid is added to the cabbage, or if inoculation is done with strongly acidifying bacteria, such as *Leptobacillus bulgaricus*, the development of chromogenic ferments is caused.; on the other hand, germs which acidify feebly, such as *Bacterium lactis acidi*, do not favour such development. An excess of salt exerts an injurious action, by paralysing the useful bacteria. The writers have shown experimentally that 4 % of salt very much decreases and 6 % entirely cancels the action of these bacteria. The presence of air is necessary to enable oxygen to transform the chromogen into pigment.

L. V.

1231 - **Frauds in the Algerian Wool Trade, and their Prevention.** — *Bulletin agricole de l'Algérie Tunisie Maroc*, Second Series, Year 28, No 5, pp 138-144. Algiers, May 1922

Algeria exports annually 90 000 qx. of wool, the greater part of which (70 000 qx) is taken by France. The natives shear with a knife cutting the fleece unevenly, a lengthy operation and somewhat dangerous for the sheep.

The wool is thrown on the ground, thus soiling it with earth, dust, etc., it is often moistened with milk serum and sand is added to increase the weight fraudulently. These practices have caused both distrust in buyers and a considerable depreciation in the value of the wool. Thanks to the interest taken in the matter by the Commercial Syndicate of Algiers and the Algiers Chamber of Commerce, the Governor General of Algeria has issued two circulars to the Prefects of the district, requesting them to bring to the notice of the chiefs of the native tribes the necessity for keeping the wool quite clean by shearing on large sheets, and of using shears and shearing machines with which an even clip may be obtained. Special precautions are recommended in the use of these machines. The Prefects are also ordered to carry out through special agents the most scrupulous inspection of the wool exposed for sale and to urge buyers to report cases of fraud.

E. F.

1232 - **The Export of Cake in France.** — *Le phosphate et les engrais chimiques*, Year XXXI, No 1352, pp. 86-87. Paris, March 1922.

The negotiations between the Minister for Agriculture and the oil manufacturers have resulted in an agreement on the following basis:—

1) The manufacturers of oil have engaged to maintain in France a monthly stock of 20 000 t. of feeding cake and 5000 t. of manure cake,

from October to April inclusive. During the months of May, June, July, August and September the stocks may be reduced to 10 000 t. of feeding cake and 2500 t. of manure cake.

2) The manufacturers of cake will establish an office in which orders will be centralised and transmitted to the various French oil manufacturers. The order Bureau will serve as intermediary between producers and consumers, while leaving full liberty to both parties.

3) For qualities of cake for which export licenses are granted manufacturers are bound to sell goods reserved for the home market at prices 10 % less than the current London market rates per complete truck load of 7000 kg. and 5 % for fractional consignments.

A de B.

## PLANT DISEASES

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

1233 - Influence of Temperature on the Distribution of Grain Smut of Sorghum (*Sphacelotheca Sorghi*) in India (1). — KUKARNI, G. S., in *The Agricultural Journal of India*, Vol. XVII, Part II, pp. 159-162 Calcutta, 1922.

GENERAL

Sorghum ("jowar") is generally sown in India from June to July, when the average temperatures in the regions where it is cultivated (Bombay, Madras, Central Provinces and Burma), vary between 21° and 30° C. This temperature is very favourable for the germination of the spores of sorghum smut (*Sphacelotheca sorghi*); the host plant grows rather slowly and hence the period during which it becomes susceptible to the disease is prolonged, so that infection is certain. In the Indo-Gangetic plains, comprising the provinces of Sind, the Punjab, the United Provinces and Bihar, where the temperature during June and July ranges from 30° to 40° C, which is too high to allow the spores to germinate, but is very favourable to the growth of the young sorghum plants, the susceptible period soon passes and therefore infection is very limited.

In order to test this view, pot cultures were carried out at the Mycological Laboratory of the Agricultural College, Poona. A small quantity of sorghum seed was taken, sprinkled with the fresh spores of grain smut and then sown in two pots. One pot was incubated at 40° C for three days and the other at 25° C which was the room temperature of the laboratory. On the fourth day, the pots were taken out and the seedlings were transplanted into larger pots which were kept under observation until the plants flowered. In the first series of pot experiments, there was no smut attack, for the spores do not germinate at 40° C, while in the second series, the attack was due to the free germination of the spores at 25° C. It is thus shown clearly that temperature is a limiting factor to the smut attack of the sorghum crop. The results of the pot experiments were tested and confirmed by field experiments made in 1918 and 1920 at Pusa, in Bihar, and at the Government farms at Larkhana and Jacobabad in Sind. Smut appeared on the Pusa and Larkhana plots in 1918 owing to the exceptionally low temperatures that prevailed at sowing time. The number of plants attacked was however very small as compared with the control plot where it was 32 %. The 1920 results at Jacobabad are however quite

(1) See also R. Sept. 1918, No. 1054. (Ed.)

definite. Smut attack was nil owing to the high temperature when the plots were sown, while it was considerable in the control plot (65 %).

These experiments, therefore, both in pot and field, go to show that temperature is the controlling factor in the distribution of grain smut of sorghum in India.

G. T.

DISEASES  
OF VARIOUS  
CROPS

- 1234 - The Sleepy Disease of the Tomato in Great Britain and the Channel Isles. — BEWLEY, W. F., in *The Annals of Applied Botany*, Vol IX, No 2, pp. 116-134, 4 pl London, June 1922.

In the British Isles and the Channel Isles, the tomato is attacked by a disease first described in 1896 by MASSEE under the name of "Sleepy Disease" and attributed by him to *Fusarium Lycopersici* Sacc. This disease causes great financial losses to tomato cultivators.

The experiments made by the author on tomatoes grown under glass in Great Britain, and especially in the Lea Valley, have shown as a result of repeated inoculations that the disease may be produced by *F. Lycopersici*, or by *Verticillium albo-atrum* McA. The wilting due to *Verticillium* occurs more frequently than *Fusarium* wilt which is comparatively rare.

In normal years, the former appears about the middle of April and increases in intensity up to the second and third week in May. Usually, the attacks cease during the second half of June, July and August, being resumed in September, when the plants die prematurely. *Fusarium* wilt occurs at the hottest part of the season, usually in July and August.

Plants attacked by *Verticillium* are usually stunted, while the internodes, especially the younger, are badly developed. When the light and temperature conditions are favourable to the fungus, the disease symptoms appear quite suddenly and the plants wilt while still green. During the night, the diseased plants may recover their turgidity, only to wilt again as the morning advances. The leaves wither from the base of the plant upwards; adventitious roots grow from the stem and the plant dies. Death is much slower when the conditions are less favourable to the fungus; yellow blotches appear on individual leaflets on the lower leaves, and these leaflets wither.

These two wilt-producing fungi attack the roots and grow up through the vascular bundles into the stem, leaves and sometimes the fruit. The wood of a diseased plant is of a light or dark brown colour.

The author's researches have proved that *F. Lycopersici* grows best at an average temperature of 27.8-28.9° C. If the temperature remains constantly much below this, little infection results. *V. albo-atrum*, on the contrary, develops well at temperatures from 15.6-24.0° C, being most active at 21.1-22.8° C. Above an average temperature of 25° C little infection occurs. The average temperature conditions existing in glass-houses in Britain are generally too low for *F. Lycopersici*, and consequently it is rarely found to be the cause of tomato wilt. The relatively low temperatures are, on the other hand, favourable to *V. albo-atrum* which in consequence is the most important cause of wilt. Wilted plants soon die when the temperature is low, but if the average temperature be raised

above 25° C, they recover, and will bear a crop as long as the high temperature is maintained. When the thermometer again drops, wilt appears and death ensues.

*V. albo-atrum* from tomato readily induces wilt in the potato (*Solanum tuberosum*), egg plant (*Solanum melongena*), snapdragon (*Antirrhinum* sp.), cucumber (*Cucumis sativus*), sycamore (*Acer* sp.), cotton (*Gossypium herbaceum*), pepper plant (*Capsicum* sp.) and elm (*Ulmus* sp.). In the first four, definite wilt disease and subsequent desiccation were produced. In the sycamore and cotton, the plants were much stunted and the leaves withered without wilting, but in the pepper, the leaves wilted and remained green. The elm plants were stunted, but only a few leaves were affected.

In pure culture *V. albo-atrum* produced a large number of enzymes of which the following were determined : amylase, inulase, emulsin, lipase, protease, erepsin and amidase. There are thus strong indications that substances of a toxic nature play an important part in producing wilt.

Most of the varieties of tomato grown in Britain are susceptible to *V. albo-atrum*. The harder-growing varieties and plants suffering from starvation, or a severe check in the young stages, are most liable to attack. Manx Marvel is a variety that has proved practically immune, and Bide's Recruit is highly resistant. Experiments carried out with different soils show that there is no necessary relation between *Verticillium* wilt and any particular soil type. Generally speaking however plants on soils which contain a large amount of humus are more attacked than those growing on poorer soils. Clay soils, in virtue of their greater water-holding capacity, are cooler than sandy soils, and plants growing on clay soils are more prone to wilt than those growing on sandy soils.

Investigations to determine the chemical agents best suited to eliminate the pathogenetic organisms from the soil are now in progress and experiments are being made to ascertain the effect of different manurial treatments upon the incidence of the disease.

In places where the disease has been common in previous seasons, it is advisable to grow a highly resistant variety, such as Manx Marvel, or Bide's Recruit. Care should be taken to protect the plants from any check in their development, and to encourage soft rather than hard growth. When *Verticillium* wilt appears, the temperature of the glasshouse should be raised until the average day and night temperature is above 25° C. This may be done by increasing the boiler heat, regulating the ventilation and closing the ventilators for two or three hours in the middle of the day. A light dressing of whitewash on the glass makes the conditions still more favourable for the plants. As little water as possible should be given to the roots, as excess moisture aggravates the wilting, but a slight overhead damping is beneficial. The development of fresh roots ought to be encouraged by mulching the soil at the base of the plant. In one nursery 78 % of the plants were showing symptoms of wilt disease before the above methods were employed ; a fortnight later, only 10 % remained wilted. In view of the fact that low spring temperatures favour infection by *Verticillium*, some advantage might be gained by planting later than is usually

done, so that the higher summer temperatures may arrive before the plants are infected.

As regards sources of infection, it is important to remove completely all plants killed by wilt disease and to clear away the general débris after the crop is finished. The best way to remove the plants is to cut each one off at about 3 in. from the soil and take away all the aerial portions including leaves etc., which have fallen to the ground, before attempting to remove the roots. If the surface is quite clean before the roots are pulled up, there is less chance of incorporating diseased matter in the soil, and the roots may then be carefully extracted, leaving behind only the very fine rootlets.

Another source of infection is the contamination of the baskets used to carry the tomatoes to market, as they are easily interchanged and infection is thus conveyed from one nursery to another. Baskets should not be taken near the growing plants and must be well sterilised during the winter months. The importation of young plants from other nurseries is also to be avoided, and care should be taken to use a pure water supply. It is desirable that the immediate vicinity of nurseries be free from weeds, and potatoes and antirrhinums should be banished, as they are susceptible to *Verticillium*.

An attempt is being made in the Chestnut Research Station laboratory to obtain a *Verticillium* resistant strain of tomatoes.

G. T.

1235 - *Mycosphaerella citrullina*, an Ascomycete injurious to various Cucurbitaceae, in Japan (1). — HEMMI, T., in *Phytopathology*, Vol. XII, No. 8, pp. 394-397. Lancaster, Pa., August 1922

Until 1919, according to the author, *Mycosphaerella citrullina* (Smith) Gross. had never been reported as occurring in Japan, but in August 1919, the melons grown under glass at the Sapporo Department of Horticulture were found to be suffering from an unusual disease.

The symptoms of the malady and the microscopic examination of the fungus which made its appearance upon the infected plants, convinced the author that the pathogenetic agent was *Myc. citrullina*. In the summer the fungus was again found in the same glasshouse, and also in the greenhouse of the Botanic Garden in the town of Sapporo.

It was also observed on the stems and leaves of cucumber and of *Lagenaria vulgaris* Ser. var. *Gourda* Ser. sent from Mihomoura in the Prefecture of Shizuoka.

Spraying with Bordeaux mixture has been recommended for the control of the fungus, but it had no effect in the Sapporo greenhouse; this was probably due to the fact that the disease was not noticed until already very far advanced.

G. T.

(1) See also: *R. May* 1911, No. 1546; *R. April* 1913, No. 429; *R. Feb.* 1918, No. 238. (Ed.)



- 1236 - *Bacillus Carotovorus*, the Cause of Soft-Rot in cultivated Violets in England. — LACEY, M. S., in *The Annals of Applied Biology*, Vol IX, No. 2, pp 169-170. London, June 1922.

In the early part of 1921, a disease of some considerable importance occurred among the cultivated violets at the Hayden Violet Grounds, Stourpaine (England).

The plants, when examined by the author, were in an advanced state of decay; the whole interior of the stem was reduced to a soft white pulp, and the rot was spreading up the petioles; several of the leaves had already decayed at the base of the petioles and fallen off, and others were dying from the same cause. From this material, a pure culture of a white micro-organism was obtained, which when inoculated into plants of garden violets, soon produced a rotting of the tissues, while the controls remained perfectly healthy. This micro-organism also produced white rot of carrots, turnips, potatoes and onions. It has been identified as *Bacillus carotovorus*.  
G. T.

- 1237 - *Thielaviopsis paradoxa*, a Hyphomycete injurious to the Coco-Nut Palm in Florida (1). — FULTON, H. R., in *Phytopathology*, Vol XII, No 8, pp 398-399 Lancaster, Pa., August 1922

The stem of a coco-nut palm from the county of Dade (Florida) proved when cut, to be affected with an extensive and deep-seated rot. The sections provided cultural material from which was obtained a fungus exactly corresponding to the description of *Thielaviopsis paradoxa* (de Seyn.) v. Höhn.

In order to secure further confirmation of the identity of the fungus, two sound pine apples bought in the market were inoculated with pure cultures of the parasite, numerous punctures being made. Other portions of the same fruits and a third control pine apple were punctured without inoculation. The typical decomposition of the tissues produced by *Thiel. paradoxa* soon made its appearance at all the points of inoculation, but was absent from the control punctures. A hot-house pine-apple plant, var. Red Spanish, has been successfully inoculated by puncturing the leaves. A pure culture of *Thiel. paradoxa* was also obtained from artificially-infected pine-apple leaves and fruits.  
G. T.

- 1238 - *Rosellina Caryae* n. sp. an Ascomycete injurious to the Juglandae, *Carya ovata*, in Michigan. — BONAR, J., in *Phytopathology*, Vol XII, No 8, pp. 381-385, figs 3. Lancaster, Pa., August 1922.

At the beginning of the spring of 1921, some twigs of *Carya ovata* were gathered near Ann Arbor (Michigan), which though they bore vigorous buds, were characterised by dead, depressed areas, containing, as was discovered on examination, the fructification of a fungus. It was found, on visiting the locality from which the material had been taken, that the tender, growing parts of many young individuals of *C. ovata* had been attacked and were disfigured by more or less marked cankerous growths.

(1) See also: R. Aug. 1922, No 886. (Ed.)

These growths, when situated on the branches, occurred nearly always around the leaf-scars, or at the tips. Frequently, they were clearly separate around a leaf-scar; at other times, they coalesced and caused the death of the branch, especially near the extremity, where the disease was most developed. The cankers varied in size, but in all cases followed the long axis of the branch extending upwards and downwards, but rarely attacking the sides, except in very young branches; they seldom entirely surrounded the branch. The disease spread from the lateral branches to the main branch forming a dead, depressed area round the point of insertion, but not often extending further.

On the larger branches and on the stems of young trees, these cankers assumed different shapes; none were however seen on stems with a diameter of 10 cm. The trees attacked had a knotty, twisted, irregular appearance.

The fungus fructifications were of the structure peculiar to pycnidia; they were always found in the branch cankers, but never in those on the stems.

Some stylospores that were collected and grown in cultural media germinated rapidly and produced new pycnidia. Branches of *Carya* on being put into sterilised test-tubes and inoculated with a pure culture of the fungus, became covered with mycelium in which the formation of pycnidia was observed.

Other naturally-infected branches were taken from the place where the disease had been discovered to the laboratory, where after careful sterilisation, they were placed in sterilised test-tubes containing a small amount of sterilised water. At the end of six months, numerous fructifications appeared on the bark of one of the branches, these were perithecia containing a large number of ascospores. From cultures of the ascospores a fungus bearing pycnidia was obtained similar from the morphological and cultural standpoints to the fungus isolated from the cankers on the branches.

The ascophore stage of this fungus can be referred to the genus *Rossellinia*, and as this species appeared not to have been already described, the author gave it the name of *R. Caryae*. The pycnidial stage has been relegated by the author to the genus *Dothichiza* and described under the name of *D. Caryae* n. sp. G. T.

## WEEDS AND PARASITIC FLOWERING PLANTS

1239 - *Lilium Bulbiferum* as a Weed in Prussia. — BREHM, in *Deutsche Landwirtschaftliche Presse*, Year XLIX, No 62, pp 407-408 Berlin, Aug 5, 1922

*Lilium bulbiferum*, chiefly known as an ornamental garden plant, may sometimes become a troublesome weed in the field.

This happened on a small scale in the neighbourhood of Geestemünde (Hanover) and of Scharnebeck.

Probably this lily came from a garden in the village of Nesse about

ten years ago and found its way into the fields, where conditions were so favourable as to cause it to spread all round Nesse.

It is detrimental to crops since it takes a considerable amount of water and nutriment from the soil and deprives the neighbouring plants of light. It should be remembered that it is a vigorous plant with great powers of reproduction, not only by means of the principal bulb underground, but also from numerous small bulbs which form every year at the axil of the leaves. Consequently to stop its further spread, care should be taken to avoid carrying not only the bulbs but also any other part of the plant from one place to another, even in manure and soil.

When once established in a field, the best means of destruction is deep ploughing so as to bring the bulbs to the surface and their subsequent collection and removal from the field together with the remainder of the plant.

G. T.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

1240 — **Lepidoptera in Cyrenaica.** — TURATI, P., and ZANON, V., in *Atti della Società italiana di Scienze naturali*, Vol. LXI, pp. 132-178, figs. 5. 1 pl., Pavia, 1922.

GENERAL

A contribution to investigations on the Lepidoptera of Cyrenaica based chiefly on the material collected during the last few years around Benghazi and especially in the Fouehat oasis by Father V. ZANON who also wrote the introduction to the work analysed and the notes and data giving the time of capture, ecology and biology. The classification and new descriptions are due to Count E. TURATI. To render the list more complete, the species found by other investigators (GHIGI, FESTA, and FIORI), in various parts of Cyrenaica which have been already published in part, have been inserted.

From the economic point of view, the following Lepidoptera should be mentioned.

- 1) *Papilio machaon*, L., living on cultivated fennel;
- 2) *Pieris brassicae catolauca* Roeb., on cabbage crops;
- 3) *Leucochloë daphnice albifera* Oberth., also on cabbages;
- 4) *Colias croceus minor* Vryt., on lucerne; this insect causes great damage, sometimes endangering a whole crop which the Arabs then reap and water the soil with water in which they have left a considerable quantity of *Pithouranthos tortuosus* in soak overnight; the penetrating odour of fennel given off by this water drives away the caterpillars from the watered soil;
- 5) *Pyrameis cardui* L., harmful to the cultivated cardoon and to artichokes;
- 6) *Acherontia atropos* L.: the first generation causes much damage to the egg-plant and the second attacks the tender tips of olive branches; this insect is also very troublesome to hives;
- 7) *Celerio lineata livornica* Esp., on the vine;
- 8) *Hippotion celerio* L., also on the vine;

9) *Earias insulana anthophilana* Guell (1) harmful to *Gossypium barbadense* and *Hibiscus esculentus*;

10) *Euvoa segetum* Schiff., on salads, pimento, etc.;

11) *E. exclamatoris* L., very common parasite which does much damage to garden crops;

12) *Rhyacia ypsilon* Rott., harmful to lettuces;

13) *R. pronuba* L., harmful to garden crops and very common;

14) *Triphaena fimbria* L., common on lettuces;

15) *Baratra brassicae* L., on peas;

16) *Xylina ovoletta* L., on peas and *Lathyrus odoratus*; also attacked flax in 1919, destroying the whole seed crop; if this crop is to be extended, it should be grown in rotation, with 3 or 4 years interval, to avoid losses; at the same time the caterpillars should be collected early in the morning, and the adults should be caught at night by means of light-traps;

17) *Trigonophora meliculosa* L., on lettuces;

18) *Laphygma evigra* Hb., on all garden crops;

19) *Phytometra gamma* L., harmful to lettuces, pimento and pinks; the caterpillar gnaws the centre of the flower buds of the pinks;

20) *Phyt. chalcites* Esp., common on the tomato;

21) *Anua tirrhaea* C., on pomegranates;

22) *Ephestia kuehniella* L., very harmful to the castor-oil plant;

23) *Ceutorhiza isidis* L., harmful to cassia;

24) *Hellula undalis* L.; causes enormous damage to cabbage crops; the tops which shelter the caterpillars should be pulled off and burnt; light-traps are very useful for catching the adults at night; a Hymenopteron has been found which is an endophagous parasite of the chrysalides;

25) *Pyrausta nubilalis* Kb., on maize;

26) *Carpocapsa pomonella* L., on the apricot and peach tree;

27) *Simaethis nemorana* Kb., on the fig;

28) *Plutella maculipennis* Crl.: infests gardens; harmful to maize and cabbages.

G. T.

MEANS  
OF  
CONTROL

1241 - ***Sigalphus luteipes*, a Hymenopteron Parasitic of *Larid rufimana*, the "Bean Bruchus", in England** -- GIMMINGHAM, C. T., in *The Entomologist's Monthly Magazine*, Vol. LVIII (Third series, Vol. VIII), No. 701 (No. 91), pp. 226-228. London, October 1921.

In 1921, a small area of field beans grown at the Research Department of the Olympia Agricultural Company at Offchurch in Warwickshire was infested to an unusual degree by *Bruchus rufimanus* (= *Larid rufimana*). Shortly after the beans had been harvested, and before the majority of the beetles emerged, a Hymenopteron evidently parasitic on the *Bruchus* appeared in great numbers. The insect was afterwards identified as *Sigalphus luteipes* Thoms (fam. Braconidae). The main period of emergence of the Braconid was from July 24 to August 7, while the beetles began to appear in numbers about the end of July and continued to emerge for a month or more. Both insects were frequently observed during the

(1) See also R. March 1921, No. 353 (Ed.)

actual process of emergence, and it was noted that the tough skin of the bean presented a very serious obstacle to the Braconid, so that many individuals died without being able to get out into the open. Each parasitised *Bruchus* larva produced only a single parasite. Occasionally, beans were found which had contained two of the larvae of this beetle (sometimes one or both parasitised), but each made a separate exit hole. The exit holes of the *Sigalphus* are about 1 mm. in diameter, while the *Bruchus* makes a large hole with a diameter of 2-2.5 mm. It was therefore easy to distinguish between the two, and advantage was taken of this fact to make counts which give an idea of the percentage of beetles that had been destroyed by the parasite. The beans were harvested in a number of small lots usually from single rows. In three of the lots that seemed fairly typical as regards *Bruchus* attack, the beans were divided into three groups 1) those unattacked; 2) those with a small hole made by *Sigalphus*; 3) those with a large hole made by *Bruchus*. The number of beans in each group were then counted with the following results.

	Lot I	Lot II	Lot III
Number of beans unattacked	722	872	120
"    "    "    from which <i>Bruchus</i> emerged	204	201	25
"    "    "    from which <i>Sigalphus</i> emerged	213	325	66
Percentage of beetles parasitised	51.1	61.8	72.5

The percentage of parasitism is high and the Braconid must have reduced by one half the number of beetles reaching the adult stage.

In all the lots of beans examined, the great majority of those attacked were young. The infested beans in which the *Bruchus* completed its transformations tended on the whole to be smaller and more shrunken than those in which the *Bruchus* was parasitised.

So far however as was observed, the plants produced in 1922 from the beans attacked by the beetle in 1921 did not show any signs of having suffered, and were no less vigorous than those grown from whole seed. The embryo is apparently rarely if ever eaten or damaged by the *Bruchus* larva. Very few of the beetles were to be found in the 1922 crop.

G. T.

1242 - *Apantheles melanoscelus*, a hymenopterous Braconid Parasite of "bombyx disparate" (*Porthetria dispar*) imported from Sicily to New England. — CROSSMAN, S. S., in *United States Department of Agriculture, Bulletin* No. 1028, pp. 25, 1 fig., 5 pl. Washington, D. C., 1922.

From 1905 until December 1, 1911, the state of Massachusetts and the Bureau of Entomology of the Department of Agriculture of the United States made a common fund of the money allocated to the discovery in Europe of the natural enemies of "bombyx disparate" (*Porthetria dispar* L.) and of "bombyx cul-brun" (*Euproctis chrysorrhoea* L.) and expended it upon the introduction into New England of parasites attacking these two Macrolepidoptera.

Among the imported insects was the Braconid Hymenopteron, *Apan-*

*teles melanoscelus* Ratz., which is the special enemy of the larvae of bombyx disparate.

The Bulletin analysed gives a detailed description of the species and its life-cycle. It also contains an account of the introduction of the Sicilian hymenopteron into America and its establishment in the country.

*A. melanoscelus* which was introduced into New England in 1911, has now become completely acclimatized. It has propagated itself very rapidly in the neighbourhood of all the colonies that have been established, in spite of the fact that it is in its turn severely attacked by parasites.

It has been found that this Hymenopteron can accomplish its life-cycle on different insects native to America. This greatly increases its value as an imported parasite and renders its acclimatisation more certain than if "bombyx disparate" were its only host.

There are two annual broods of *A. melanoscelus* and both live at the expense of the larvae of *Potchetria dispar*. *A. melanoscelus* is very common in many small areas and promises to become one of the most effective of the imported parasites.

G. T.

1243 — The Control of *Heteroderes amplicollis* and other Coleoptera harmful to Tobacco in Cuba. — CAIVINO, M. in *Revista de Agricultura, Comercio y Trabajo*, Year V, Vol. 5, No. 4, pp. 15. fig. 1. Havana. June 1922

The Cuban planters give the name of "tobacco pasador" to the larvae of certain Elaterid Coleoptera which live in the soil and attack the young plants as soon as they are planted, perforating their stems and killing them. The common «pasador» is the larva of the *Heteroderes amplicollis* Gyll. Other equally harmful species exist, such as the *Conoderus bipoveatus* Beauv. and the *Megapenthes opaculus* Cand.

The damage caused by these insects to tobacco is considerable, especially at Vuelta-Abajo.

Two years ago HERNÁNDEZ, a planter at Saint-Louis (Pinar del Río), noticed that where the hose leaked very much, so that the soil was soaked at the moment of transplanting, all the seedlings took root and were not damaged by the "pasador", whereas the neighbouring plants in the places where the water was lacking were attacked. He immediately concluded that the water drives off the "pasador" and that watering the soil at the moment of transplanting was the most practical way of defending the plants against the attacks of their enemy. Next year HERNÁNDEZ, having confirmed the correctness of his observation, communicated it to ARGUDÍN, Superintendent of the Cubana Land and Tobacco Leaf C'os y plantations, at Vivero, San-Juan and Martinez who decided to test it by letting water run into the furrow before planting.

Planting was effected by pressing the young plant with the finger into the raised bed immediately after watering as above described. After 4 or 5 days water was again allowed to flow round the young seedlings and when it had run off manure was placed round each plant on the wet soil and it was then covered with dry soil from the furrow.

The experiments made by ARGUDÍN on a large scale at San-Juan and Martínez in many districts which were formerly much infested by the "pasador" have proved that this method is excellent and has finally solved the most important problem in tobacco culture in the district.

This method of planting in wet soils — which the writer proposes to call the "Argudín Lorenzo Method" — also prevents any plant wilting during transplantation, as the water causes the soil to adhere quickly to the roots of the young plants. It marks real progress in transplanting not only tobacco, but also garden crops generally which are cultivated in a similar way, for, by covering the wet manured furrow with soil, watering and other costly operations are avoided and a better use is made of the necessary fertilisers applied to each plant before earthing up. G. T.

1244 — **New Method for the Control of *Aleurocanthus woglumi*, a Rhynchote injurious to Fruit Trees in Cuba** (1). — CALVINO, M., in *Revista de Agricultura, Comercio y Trabajo*, Year V, Vol V, No 1, pp 4-6, figs 6. Havannah, June 1922.

This year, the author adopted against *Aleurocanthus woglumi* (popularly known as the "Mosca prieta" or black fly), which has appeared on the fruit trees cultivated at the "Estación Experimental Agronómica" of Santiago de las Vergas, the same method which he had used successfully several years previously for the control of *Phloethrips* in Liguria (Italy). This method consists of cutting off and burning all the branches of the diseased and healthy trees within a zone of 100 to 200 metres.

The work was carried out in Cuba during January and February, although December is a better month for the purpose. The same treatment was adopted for trees covering three hectares, consisting chiefly of young mangoes, avocados, medlars, coffee-trees and different kinds of citrus trees.

The results obtained were most satisfactory. One month after the pruning, the orange-trees which were the first to shoot, were covered with fresh and very healthy and vigorous branches and the mangoes, avocados, etc. soon followed. At the present time, the orange-garden of the Station is in a far better condition than formerly, and the few Rhynchotes that were overlooked are quickly detected and destroyed by insecticide sprays.

In the case of orange-trees, the system adopted by the author not only destroys the insect but has the additional merit of rejuvenating the tree which bears a heavy crop the second year after cutting back. G. T.

1245 — ***Sitona hispidula*, *S. sulcifrons* and *S. crinita*, Weevils injurious to Leguminous Crops in Britain.** — JACKSON, D. J., in *The Annals of applied Biology*, Vol IX, No. 2, pp. 93-115, figs 5, 1 pl. London, June 1922.

*Sitona hispidula* F. is common and widely distributed in the British Isles; where present, it does injury to clover and lucerne, though the damage caused has not hitherto been recognised. The adults eat the leaves of the host plant, while the larvae attack the roots.

*S. sulcifrons* Thun is also very abundant in Great Britain and

INSECTS, ETC.  
INJURIOUS  
TO VARIOUS  
CROPS

(1) See: P. Sept. 1921, No 955 (Ed)

is common upon red clover, especially in the north of Scotland. The adult insects feed upon the leaves of clover like those of the preceding species. The larvae seem principally to eat the root nodules of the clover and they sometimes damage the small fibrous roots that bear these nodules.

Unlike the larvae of *S. hispidula*, they have never been observed to attack the main root.

*S. crinita* Herbst has not so far been found by the author in sufficient numbers to cause injury to leguminous crops, but its profusion upon tares in the south of England is recorded by several observers, and it has been seen very commonly on vetches in Kent and Cambridgeshire. It frequents the same food plants as *S. lineata*, which is always however in much greater profusion. Occasionally it has been found on peas and beans in England, and was common on sainfoin in 1907; in 1920 it caused serious damage to the young flowers of *Cytisus biflorus* at Wisley.

*S. crinita* is rare in Scotland.

The adult weevils eat semi-circular patches from the edges of the leaves. The larvae feed upon the root nodules, and sometimes bore channels in the main root close to the surface of the ground.

In this paper separate morphological descriptions are given of the different stages in the development of the three species referred to, and their life-history is published for the first time in Great Britain. As regards their natural enemies, the Braconids, *Perilitus rutilus* Nees, *P. aethiops* Nees and *Pygostolus fuscatus* Nees have been reared from adult forms of *S. hispidula*; *P. cerealium* Hal. and a species of *Liophron* have similarly been obtained from adult forms of *S. sulcifrons*. A Braconid of the genus *Perilitus* was reared from *S. crinita*.

Hymenopterous larvae are occasionally found in the bodies of beetles of all three species. Parasitic protozoa probably belonging to the genus *Gregarina* have frequently been found in the alimentary canal of the adult *S. hispidula*. The fungus *Botrytis bassiana* (Bals) Mont. seems to be the most formidable enemy of the adult and larval forms of *S. hispidula*; it also attacks both forms of *S. sulcifrons* and the adults of *S. crinita*.

G. T.

1246 — *Hypopta caestrum*, a Macrolepidopteron injurious to Asparagus, in France. — JEAN, C., in *La Petit Provençal*, Year XLVIII, No 16560, p. 5. Marseilles, June 14, 1922.

Although somewhat rare and only found in large numbers here and there, the larvae of *Hypopta caestrum* H. occasionally as the author has noticed in certain places in the valley of the Durance cause considerable damage to asparagus. The larvae devour the shoots and make galleries in the roots and rhizomes, and they are capable of doing serious mischief. Newly-made beds, where the root-systems of the plants are little developed are the greatest sufferers.

The author describes the morphology and life-history of the insect. As regards the means of control, burning or crushing the cocoons is



an easy and effective method, but only practicable over small areas. It is preferable to destroy the larvae from December to February by dibbling in 20 to 30 gm. of carbon disulphide per m<sup>2</sup> using 4 strokes of the dibble, or by pouring a solution of sulpho-carbonate of potassium (500 gm. per hectolitre of water; for practical work 250 to 300 gm. are sufficient) into small shallow channels, or preferably into holes 25 cm. deep, allowing 4 holes to the square metre.

G. T.

1247 - The "**Bombyx Disparate**" (*Porthetria Dispar*) injurious to Oaks in Morocco. — *Bulletin de la Societe d'Histoire Naturelle de l'Afrique du Nord*, Vol XIII, No 6, p 198 Algiers, 1922

At a meeting of the Natural History Society of North Africa held on June 10, 1922, DE BERGEVIN gave an account of his observations as to the great damage done by the "bombyx disparate" to oaks in the Mamora forest (Western Morocco)

In this connection M DE PYRIMOFF pointed out that this Macrolepidopteron also exists in Algiers where however it is kept from spreading by numerous parasites, which he is of opinion it would be possible to acclimatize in Morocco.

G. T.

[1246-1247]



INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

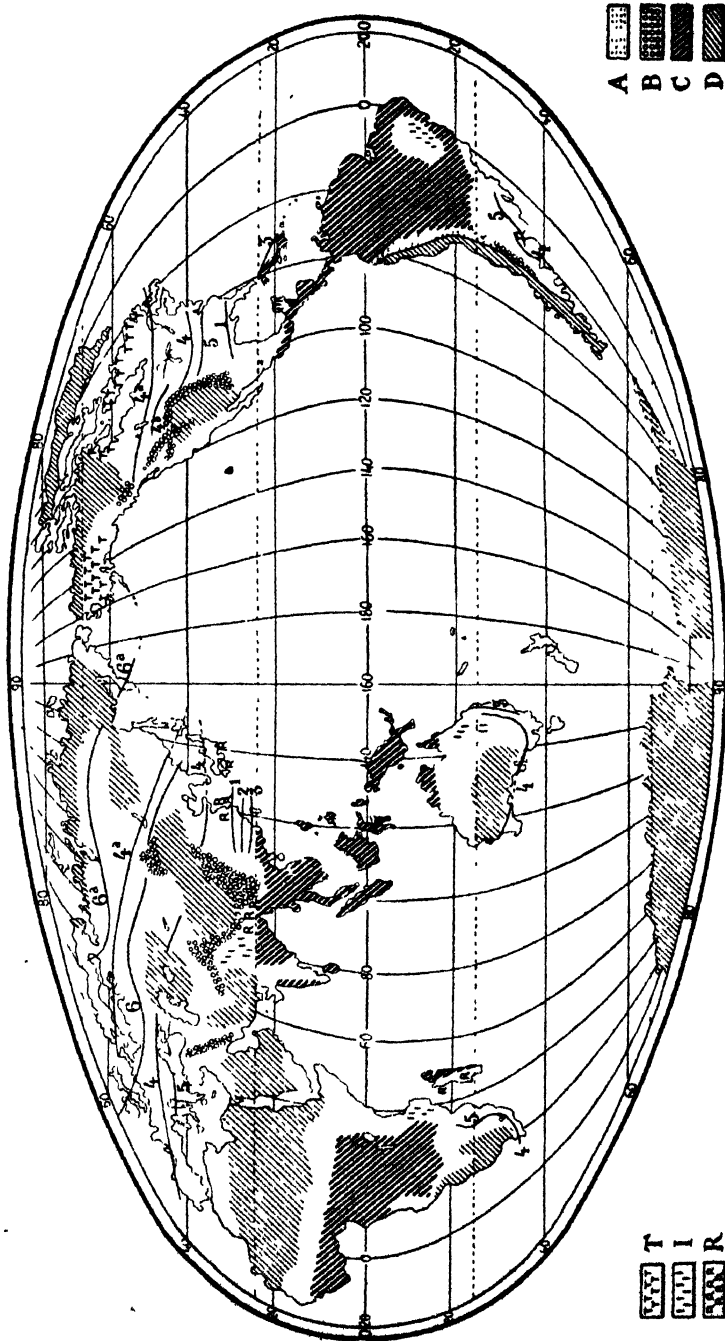
1248 - **White Settlement and World Agriculture** — LAYTON G. (University of Sydney), The Institution of Future White Settlement, A World Survey Based on Physiographic Data, in *The Geographical Review*, Vol. XII, No. 2, pp. 375-402, figs. 9. New York, N. Y. July 1922.

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

From the point of view of white settlement there are four types of land surface which are unsuitable. These are first, the tundras of the polar regions, which are too cold for our ordinary domestic animals and also usually too dry though there is a possibility of the development of a large-scale reindeer industry. Secondly, and most important, the desert regions of the world, which are too dry for agriculture though a certain amount of stock can live therein. Thirdly, the rugged mountainous regions and the high plateaus of the colder belts. In tropical regions of course the plateaus are much more favorable for settlement, but unfortunately they are not very extensive. HUNTINGTON, however, believes that most tropical plateaus suffer from the excessive monotony of their climate and the fact that the healthy *variety* of temperate regions is absent. On the other hand, BOWMAN states as regards the tropical plateaus that there are two distinct seasonal climaxes, one at the height of summer and one at the height of winter; for the plateaus of Peru and Bolivia these climaxes last for a period of about six weeks, with very important effects upon the life of the region. Fourthly, there are the hot wet regions of the tropics, where the natural resources are abundant but the climate is quite unsuited for white settlement on any considerable scale or indeed for any form of white settlement requiring constant manual labor.

In the map here reproduced these four types are given in a generalized form. The regions left blank are those suited for some form of Eu-

Map showing in generalized form regions suitable for white settlement and crop zones of the temperate lands.  
 Shaded areas (ruled or dotted) are more or less unsuitable for white settlement.



T = Tundra; I = Akin to Indian Wheat; R = Rice.

A = Over 6000 ft., tropical; B = Over 6000 ft., temperate; C = Over 40 inch Rainfall; D = Under 10 inch Rainfall.

1 = Cotton; 2 = Tea; 3 = Sugar; 4 = Wheat; 5 = Maize; 6 = Rye; 7 = Limit of Rye.

The areas shown white represent the regions suitable for the white race; the shaded portions those that are only to a greater or less degree suitable.

ropean settlement. Almost the whole of Europe and North America is available, about half of Asia and Australia, and relatively small proportions of Africa and South America.

In the moderately watered tropical regions a considerable population of *pastoral* whites will probably develop, but in the author's opinion there is no prospect of any large agricultural settlement. In the temperate regions are inserted the zones where the most important crops thrive.

In the northern hemisphere the zones, like the chief mountain ranges, run for the most part from east to west and these zones are broken by the arid and mountainous regions. In the southern hemisphere the trend lines of the continents run north and south and the crop belts more or less follow this direction. In no case does the crop region extend to the desert areas, but a belt of stock country always occupies the margins of the desert.

The optimum of the wheat crop is near the optimum of white settlement in northern lands. In southern lands the present wheat optimum — in easily tilled prairies — is on the dry side of the optimum of white settlement.

G. A. B.

1249 - **Agriculture in Greece.** — LADAS, S., in *l'Economiste d'Athènes*, Year II, No. 29, pp. 452-555. Athens 2 15 Aug 1922 (1)

The present condition of agriculture in Greece does not differ very much from that of the Roman period. Most cultivators still use wooden ploughs with iron ploughshares. The only other agricultural implement used by farmers is the scythe. Sowing is done by broadcasting as seeding machines are unknown. Threshing is generally done by means of horses or oxen. Threshing machines, rollers, etc., are almost unknown. Manures are seldom used, sometimes the dung of draught animals is put on the land when it is not used by the country people for fuel after drying. If the farmer owns flocks of sheep or goats, which is seldom the case, he manures his fields with their dung by letting them graze there after the harvest. It is only recently that chemical manures have begun to be used in very small quantities, to the extent of 6000 tons a year, chiefly on large estates and for special crops.

There are many kinds of cultivation and the practice of allowing land to lie fallow is often adopted in Greece, both on large and small estates. This is considered necessary to prevent soil exhaustion; but really it is of no use since it does not restore to the soil any of the substances which have been taken out of it. The only result is that the farmer restricts his crop to one half or one third of his field and deprives himself of the crop from the other half or two thirds each year. At the same time the national yield decreases. For the farmer especially the loss is certainly greater than the amount which he would spend on the regular manuring of his field, which would in that case return him a crop twice or three times as large. The rotation system is also defective and entirely a matter of rou-

(1) See *R. Sept.* 1922, No. 900. (Ed.)

tine ; it leads to the cultivation of crops which are neither the most profitable nor most suited to the nature of the soil. It leaves out of account the fact that all crops do not require the same degree of heat and moisture ; a cold rainy place is suitable for growing wheat but not for barley, etc. Moreover, the kind of crop to be grown is chosen in a routine manner according to the colour of the soil, neighbouring cultivation, etc., whereas none of these indications are of great value. The choice of the crop which suits each soil and vice-versa is a matter of great importance to the future yield. Planting and sowing should be done according to the nature of the soil.

Viticulture is also very defective in Greece. Tillage is superficial ; manures unknown ; pruning is done hap-hazard. The use of sulphate of copper, so common at the present time, is still a matter of very great difficulty in Greece, subject as it is to all the conditions of bureaucracy and in consequence often arriving too late. The vintage takes place at a fixed time, without proper consideration of the ripeness of the grapes, because the changeableness of the weather obliges the wine-dresser to hasten the gathering of the grapes. As for wine-making and distillation, they are carried out in a very defective manner, without those modern scientific methods which enable wine to be well made and to keep well.

As regards oil-growers, they are ignorant of the most elementary rules. The olive trees receive no attention. Their owners, like the owners of other fruit trees, took them as natural gifts intended to yield fruit without any trouble to themselves. Consequently it is by no means uncommon to find that fruit trees, and especially olive trees, are attacked by various diseases which cause great loss and in some places even destroy the crop. The lack of elementary agricultural knowledge is noticeable even in the gathering of the fruit, which is not done at suitable times, as well as in the manner in which the gathering is done which causes much waste of fruit. The extraction of oil from the olives is also done in a defective way ; it is mainly done by means of crushing mills worked by horses and with the greatest disregard of cleanliness. Water power oil presses are not found in Greece.

Breeding is insignificant and carelessly looked after. Generally the farmers own no animals except their draught animals (one or two oxen or horses) which, after all, form the necessary complement of agricultural economy. Such animals as there are, pass their whole life in the fields and are herded in roofless enclosures, exposed to all weathers ; in winter they are very frugally fed and in consequence they are thin and weakly and of little value. Professional breeders, without the most elementary knowledge of breeding, often see their flocks and beasts of burden die without being able to help them in any way.

G. A. B.

AGRICULTURAL  
EXPERIMENT

1250 - **Agricultural Experimentation in Assam during the Year ending March 31, 1922.** — MAC SWINEY, J (Director, Department of Land and Agricultural Records, Assam), in *Report of the Agricultural Department of Assam for the year ending March 31, 1922*, 12 pp Shillong, 1922

Assam possesses four Agricultural Experiment Stations. These are situated respectively at : 1) Jorhat — 2) Karinganaj — 3) Upper Shillong

— 4) Shillong. An estate has been bought at Titabor for the establishment of a Rice-growing Experimental Station.

1) At Johrat, most of the experiments are carried out on high ground where the soil is a fairly compact, reddish, ancient alluvium; the sub-soil is stiff and yellowish-grey. These soils have an acid reaction and are poor in lime and phosphates, for which reason experiments in liming and the application of phosphatic manures are in progress.

The first liming experiments date from 1909; a piece of land that was limed that year is still producing good crops after 13 years have elapsed, though it is true that the yield is gradually diminishing. The adjoining unlimed field is however unsuitable for any crop.

It was found on comparing the effects of heavy applications of lime at long intervals with those of small and more frequent doses that although the heavy applications produced larger crops for the first few years, after the fifth season, the lighter and more frequent doses were superior. Excellent results were obtained with dung combined with wood ashes.

Land improved by the introduction of large quantities of ground limestone stood deep ploughing well, although deep ploughing was injurious where only a small amount of limestone had been applied.

In the Assam valleys, the soil is improved by the addition of any alkaline substance: lime, limestone, magnesium carbonate, and even sodium carbonate, especially if it is accompanied by some fertiliser. Chemical fertilisers (except superphosphates) used alone have no beneficial effect; ammonium sulphate is even injurious, since if applied several times, it tends to increase the toxic character of the soil.

The chief task of the Johrat Station is the acclimatisation, testing and selection of foreign and native varieties of sugar cane.

Manurial and rotation experiments are also made and good varieties of sugar-cane are distributed to the growers. Up to 1920, 4 varieties had been thus distributed: Striped Mauritius — B. 147 — B. 176 — J 33 a; in 1921, two others were added: Co 9 and D 74.

The yield (in tons per hectare) of stripped cane and saccharose (present in the expressed juice) in 1921, which was a good year, were as follows for the best varieties tested: B 3412, 46.5; 4.15 — D 74.42.7; 4.10 — J 247, 35.8; 3.83 — Mauritius 55, 38.5; 61 — Striped Mauritius 38.2; 3.84 — Co 9, 35.9; 4.3 — B 147, 34.8, 3.7 — A 2 a 33.9; 4.38. The varieties D 74 — G 33 a — Co 9 are distinguished by their resistance to lodging induced by wind.

2) At Karinganj, rice selection is carried on. For purposes of comparison are grown: pure line selection of 158 types of "aus" (winter rice) — 176 types of "sail" (transplanted winter rice) — 55 types of "asra" (a short-stemmed marsh variety of rice) — 343 types of "aman" (winter marsh rice for sowing broadcast).

Of the "aus" varieties, M 36-30 proved the best, and in 1921, its distribution to the rice-planters was begun. "Late sail" was the most-satisfactory of the "sail" varieties. This, together with "George sail"

and "Indra sail" is cultivated experimentally on a large scale by the agriculturists of the Surma Valley.

3) The chief work at Upper Shillong is the acclimatisation, testing and propagation of the potato by "seed". Of the 24 varieties tested in 1921, King of Potatoes, British Queen, Up-to-date and Emperor produced, as in preceding years, the highest yield per hectare. These are the varieties chiefly distributed for planting.

In order to obtain a supply of "seed" for distribution, the first seed-potatoes are given to expert growers who return to the Station one and a half times the number of tubers that were consigned to them, or if they wish, sell to the Station at a rather higher price all the crop suitable for planting. The seed potatoes thus obtained are sold to the agriculturists of the plain.

Of the several varieties of jute cultivated, "Kakaya Bombai" native to Bengal, has clearly proved the best. In 1921, the Station obtained two other selected varieties of Dacca jute, D 154 and Green Olitorius that will be used in a comparative experiment with "Kakaya Bombai".

Very encouraging results have been obtained from tobacco-growing in the Surma Valley. The leaf-yield of a Rangpur variety, Matihan, exceeded by 380 kg. the crop produced by the local varieties.

The experiments conducted during the last three years in the Surma Valley have shown that "dhaincha" (*Sesbania aculeata*) forms an excellent green manure for the "sail" variety of rice. It should be sown immediately after the autumn-sown crop.

Two herds of cattle, one of pure-bred Patna animals, the other consisting of hybrids Patna  $\times$  Rhutia are reared separately at the Upper Shillong Farm. The improved bulls obtained are sold to the agriculturists and the demand far exceeds the supply.

4) At Shillong, experiments are in progress with fruit trees from the temperate zones. Many varieties of apple and pear trees have already been acclimatised at this Station.

F. D.

1251 - Experimental Work in Progress in the Laboratories, Rothamsted Experimental Station, England. — *Current Leaflet*, pp 1-8. Harpenden, 1922.

The investigations and experiments carried out at the Rothamsted Experiment Station, both in the laboratory and in the field are of world-wide importance. The following résumé has been made of the experiments now in progress: —

BACTERIOLOGICAL DEPARTMENT. — Main lines of work now proceeding: —

1) A study of the rapid changes in bacterial numbers in field soil and their relationship to nitrate increase and decrease. The method of study consists in taking soil samples from a plot at two hourly intervals for periods up to 86 hours and estimating bacterial numbers and nitrate from each sample.

2) A study of the soil bacteria capable of decomposing phenol, cresol and naphthalene. These organisms are of importance as they limit



the use of the antiseptics in soil, for the destruction of pests. The investigation comprises the geographical distribution of the organisms, their physiology, and the changes which accompany the addition of phenol to soil.

3) The influence of farmyard manure on the growth of clover and other leguminous crops and on the development of the root nodule bacteria, is being studied in pot experiments and in the field.

**BOTANICAL DEPARTMENT.** — In the Botanical Department problems relating to the nutrition and growth of plants come under consideration and are dealt with chiefly in pot and water cultures. Special attention is being directed to the effect of high temperatures and excessive sunshine on growth and also to the stimulating action that appears to be exercised by very small quantities of certain chemical substances, such as boric acid, which are poisonous in heavier doses.

The comparative effect of artificial fertilisers on meadow hay is investigated by means of detailed separations of the hay from year to year, the relative amounts of the different species varying considerably with the manure.

**SOIL CHEMISTRY.** — a) *Nitrogen Cycle.*

1) The rapid fluctuation in nitrate content of field soils and their relation to bacterial numbers (in co-operation with the Bacteriological Department).

2) The rate of nitrification of sulfate of ammonia applied to field soil as early and late top dressings.

3) The fixation of nitrogen by green algae in pure culture (in conjunction with the Mycological Department, Algology Section).

4) The development of improved methods of analysis for the study of the nitrogen compounds of the soil.

5) A survey of the total nitrogen content of the soil of certain fields.

b) *Carbon Cycle:* 1) A study of the organic matter of the soil with special reference to humic products; their mode of formation, properties, and distribution.

2) The dephenolising power of the soil, with special reference to the action of manganese.

c) *Green Manuring:* The relative value of different systems of green manuring and their effect on the nitrogen cycle and carbon cycle in the soil.

**FERTILISING CHEMISTRY.** — a) *Phosphatic Fertilisers.* — A study of the citric solubility of different basic slags and mineral phosphates and its relation to their manurial value.

b) *Potash fertilisers.* — A study of the relative manurial values of sulphate and chloride of potash, and of their effect on the soil.

**ROUTINE ANALYSIS.** — A very large number of analyses of soils, manures and plant products are made every year by the assistant staff.

**FERMENTATION DEPARTMENT.** — In the laboratory for Fermentation Work the methods for converting straw into Artificial Farmyard Manure are being studied with a view to reducing the cost of production on the large

scale. The fresh water required to wet the straw is not available in many places, but a considerable amount of surplus straw lies along the Essex creeks. Straw has been treated with sea water and found to produce a satisfactory manure although the fermentation proceeds more slowly than with fresh water.

Many types of waste vegetable material have been tested and some of these yield a richer manure than straw. The quantities available in this country are however usually very limited.

INSECTICIDE AND FUNGICIDE DEPARTMENT. — The work done in this department can be classed under two headings :

1) The study of natural and synthetic products with the main purpose of correlating chemical constitution and physical state with toxicological action on plant pests and disease organisms.

During the past two years investigations have been made on the toxicity of many chemical products to soil pests such as wireworms and eelworms both on a laboratory and large glass-house scale

Certain plants poisonous to insects have been examined and one of them, Tuba root (1), found to be efficacious against caterpillars.

At present an attempt is being made to find a substitute for nicotine by examination of various synthetic products.

2) A biochemical study of the nature of immunity particularly with reference to Wart Disease of Potatoes (*Synchytrium endobioticum*) Attempts are being made to correlate certain biochemical and physico-chemical factors with immunity. Collateral properties, such as the boiling and cooking qualities of potatoes have a place in this research.

Various grafting experiments are being done and attempts made to find a fungicide capable of eradicating the disease.

PROTOZOOLOGY DEPARTMENT — The investigations of RUSSELL and HUTCHINSON on partial sterilization of the soil lead to the view that in normal soil the increase in bacterial numbers was inhibited by a biological factor provisionally regarded as the soil protozoa. Recently satisfactory methods have been devised for counting these organisms and an extended experiment covering 365 days showed that an inverse relationship exists between the bacterial numbers and those of the active amoebae.

Flagellates do not appear greatly to affect the bacterial numbers, but in one species the active numbers show a two-day periodicity. The physiology of the dominant species of soil protozoa is being investigated, and a survey made of the protozoan population of soils obtained from various parts of the world.

SOIL PHYSICS DEPARTMENT. — The properties of the soil that are at present studied in this department can be broadly divided into two groups dealing respectively with the soil particles themselves, and their relations to the soil water. The first group embraces problems of soil tilth, the effect of clay and organic matter, and the colloidal properties of soil. The second

(1) *Descurtia (Derris) elliptica*. — See R. January 1920, No. 143. (Ed.)

group includes studies of the complex relations between the soil-solution and the soil and an important investigation into the hydrogen-ion concentration of the soil-solution.

Considerable field work, involving dynamometer measurements with different implements, is done on soil cultivation, and in the meteorological section of the department observations are made on the effect of meteorological conditions on the soil.

STATISTICAL DEPARTMENT. — The statistical laboratory was founded in 1919 with a view to applying the powerful methods of analysis supplied by modern statistics to the agricultural, meteorological, and biological observations made at the Station. The Rothamsted crop weather records extend for nearly seventy years, and in accuracy as well as extent form an unparalleled body of data, for the study of the causes of crop variation. Three main causes of variation have been distinguished in the wheat yield from Broadbalk field; of these the most important is that of the weather, the very complex effects of which are in process of analysis.

INSTITUTE OF PLANT PATHOLOGY. — *Entomology Department.* — The work of this Department is divisible into 4 chief branches:

- 1) Research work on the biology of Aphides, with special reference to the Bean Aphid (*Aphis rumicis*) including factors underlying the different phases of its reproductive capacity and the relative susceptibility to attack of different varieties of broad beans and field beans.

- 2) Researches on the insect and other invertebrate fauna of the soil with particular reference to distribution in depth and the effects of manurial and other treatments of the soil.

- 3) An investigation of the relative toxicity of various chemical compounds and their possible value as insecticides (in conjunction with the Insecticide and Fungicide Laboratory)

- 4) The life-history of the gout-fly of barley (*Chlorops taeniorhynchus*), its winter host and methods of control.

MYCOLOGY DEPARTMENT. — Among the investigations in progress are: 1) The numbers, distribution and functions in the soil of the fungi and microscopic green plants (*Algae*). A monograph on these organisms and their soil activities is being prepared.

- 2) The killing powers of various chemicals, heat etc. on fungi and the way in which death is brought about.

- 3) The growth of fungi in relation to various external conditions.

- 4) The changeability of fungi and bacteria in various ways such as their power of attacking plants, etc.

- 5) Various problems in connection with wart disease of potatoes, more particularly the relation of the last to the fungus and methods of getting rid of the latter from the silo.

- 6) An intensive study of the parasitic fungus *Botrytis cinerea*, which causes grey mould.

- 7) The fixation of nitrogen by green algae in pure culture (in conjunction with the Chemical Department).

M. L. Y.

[1921]

## CROPS AND CULTIVATION

AGRICULTURAL  
METEOROLOGY

1252 - The Climate of the mountainous Regions of Minas Geraes (Brazil) in Relation to agricultural and zootechnical Conditions. — I. ALVARO A. DE SILVEIRA, in *Memo-rias chorograficas*, Vol 1, pp 1-327 Be o Horizonte, 1921. II. FERRAZ SAMPAIO, in *Boletim de Neumaes, Directoria de Meteorologia, Ministerio de Agricultura, Industria e Commercio*. Rio Janeiro, 1922.

In the mountainous regions of the interior of the State of Minas Geraes, the lowering of the temperature which coincides with increase in altitude makes possible both extensive cattle breeding and the growth of certain temperate zone crops, such as wheat and fruit trees of the Rosaceae group.

The following Table which is a record of observations made at the Meteorological Station at Caxambu gives some idea of the special climatic conditions of the region.

*Meteorological observations made at the Caxambu Station.*

Month	Temperature			Rainfall	Nebu- losity	Hours of sunshine
	mean	absolute maximum	absolute minimum			
January . . . . .	20° 6 C	32° 4 C	12° 2 C	338.3 mm	7.6	161.6
February . . . . .	20.8	33.6	9.0	177.5	6.5	165.6
March . . . . .	19.6	33.0	9.8	113.8	6.4	174.1
April . . . . .	18.0	28.8	5.8	95.2	5.2	202.5
May . . . . .	15.1	29.0	— 0.1	29.7	4.2	210.7
June . . . . .	13.8	27.0	— 1.6	20.6	3.9	203.4
July . . . . .	13.3	29.0	— 1.0	15.9	3.2	227.5
August . . . . .	14.9	30.0	— 1.6	23.7	4.0	228.3
September . . . . .	17.9	33.6	2.0	69.2	4.3	193.4
October . . . . .	19.0	32.8	3.8	150.9	6.1	178.7
November . . . . .	19.5	33.2	6.6	187.6	7.1	169.9
December . . . . .	19.9	32.6	7.2	215.4	7.4	63.0

According to this Table, the temperature often falls below 0° during winter ; in the highest localities the winter is still more severe and frosts and mists are very frequent. As the sea is approached, the temperature rises and sub-tropical and tropical areas are gradually entered. The rainfall is abundant, as is the case in all other parts of this State ; there is a dry season which corresponds with the coldest months.

WHEAT. — Apparently wheat-growing in these regions can be made to pay. Good results have been obtained at the "fazenda Cipó" by sowing on November 25 and reaping on March 20.

MEDICINAL PLANTS. — Throughout the interior a large number of very useful medicinal plants are found, notably : — an arborescent *Euphorbia*, with lobed leaves, furnishing a very powerful drug for the treatment of venereal diseases — "Gritadeira", a Rubiaceae plant of the genus *Psychotria* with yellow, tough leaves, an excellent diuretic —

*Aulomyrcia longipes* Berg. one of the Myrtaceæ, from the bark of which manna freely exudes — the Castor oil plant (*Ricinus communis*) grows wild and in great abundance.

FRUIT TREES. — In the high "sierras" formed of gneiss and other feldspathic rocks their disintegration produces a soil which is very suitable for planting European fruit trees.

SILVEIRA saw at Itatiaia, at an altitude of 2000 m, pear and apple-trees laden with very fine fruit, and at Jordão (1700 m) fairly vigorous plum trees bearing fruit.

With the financial help of the Minas Geraes Government an experimental orchard has been planted at S. Maria da Fê with pear, apple and cherry trees.

ALTITUDE LIMIT OF TROPICAL, AND SUB-TROPICAL CROPS. — On the José Mariano estates ("Sierra Cipó"), mango trees bear good fruit up to 1000 m.; citrus fruits are also grown. The coffee bush flowers all the year round, but the yield is not satisfactory.

CATTLE BREEDING. — Owing to the humidity and heavy rainfall, the pastures are always green. The wild forage plants are excellent; it is sufficient to mention *Arundinaria canavieira* Alv. Silv the composition of which is as follows —

Moisture .	11 72 °
Ash	2 94
Protein	6 93
Fats . . .	2.10
Cellulose	39 73
Non-nitrogenous extracts	36 58

100 00

On the Cipó "sierra", in the district of Mantiqueira, breeding can be carried out successfully at between 1630 and 2000 m. G. A.

1253 — **Effect of Meteorological Factors on the Quality and Quantity of Wheat produced in Argentina.** — HESSLING, N A, in *Monthly Weather Review*, Vol 50, No 6, pp 302 208 Washington, June 1922.

Results of a study on the relation between wheat production and meteorological phenomena in Argentina. Special importance has been assigned to rainfall and temperature.

EFFECTS OF RAINFALL. — An excess rather than a lack, of rainfall is detrimental to wheat in that part of Argentina where it is chiefly grown. The largest crops are obtained when the rainfall is nearly at its lowest, i. e. 50 to 100 mm. during the 3 winter months, and 100 to 150 mm. from September to November (see Tables I and II). Above and below this limit a decrease in yield is noticed. The decrease observed when there is an increased rainfall is not however, in proportion to this increase; there are cases when, in spite of abundant rains, a very good crop is obtained. It might be concluded from this that the decrease in yield is due less to the rains than to other meteorological factors connected with them.

TABLE. I. — *Relation between grain yield (in kg. per ha.) and winter rains (June-August).*

	Millimetres of rain							
	less than 10	10-25	25-50	50-100	100-150	150-200	200-250	250-300
Number of cases . . .	5	6	9	16	12	3	3	1
Average yield . . . . .	585 kg	588 kg	671 kg	751 kg	704 kg	708 kg	631 kg	544 kg
Maximum yield . . . . .	662	821	822	1070	1224	844	687	—
Minimum yield . . . . .	467	350	460	216	422	536	597	—

Up to the present the winter and spring rains have been considered in two separate groups. But from the data gathered by the writer it is evident that there is compensation between the two groups. When there are less than 25 mm. of rain during the winter, a good crop may still be obtained if the spring rains are very abundant. In other words, after a very dry winter season, the more abundant the spring rains the higher the yield.

TABLE. II — *Relation between grain yield (in kg. per ha.) and spring rains (September-November)*

	Millimetres of rain								
	25-50	50-100	100-150	150-200	200-250	250-300	300-350	350-500	400-450
Number of cases	1	5	11	6	11	13	5	2	1
Average yield . . . . .	353 kg	450 kg	797 kg	687 kg	674 kg	720 kg	650 kg	751 kg	572 kg
Maximum yield . . . . .	—	756	1224	909	852	989	844	860	—
Minimum yield . . . . .	—	216	561	556	440	501	422	642	—

The spring rainfall (September-November) required to ensure a maximum yield is less if the June-August fall is heavier. When the winter rainfall exceeds 100 mm., the maximum yield is obtained with the minimum spring rainfall (9.91 qx. and 100-150 mm.).

On the whole, it may be said that, with very rare exceptions, the rainfall in Argentina is always sufficient to ensure a good yield. Considering the territory as a whole, it will be found that during a period of 30 years there was only one year of real general drought, namely 1916. On the contrary, taking each province separately, it will be noticed that the winter drought becomes more frequent the further one advances into the interior of the country, for instance, in the provinces of Cordoba and the Pampa. The best rainfall, as regards quantity, is 100 mm. for the months of June and July and 100 mm. for those of September and October.

**EFFECT OF THE TEMPERATURE.** — The influence of the temperature on the yearly fluctuations in yield is much greater than that of the rainfall. In years when the yield is good, the spring temperature is below the normal, whereas it is above when the yield is poor. The yield, is therefore, in in-

verse ratio to the temperature. The following are the coefficients of correlation for each succeeding two months after sowing :

June-July . . . . .	0.10
July-August . . . . .	0.32
August-September . . . . .	0.69
September-October . . . . .	0.75
October-November . . . . .	0.67

After August the negative action of high temperatures becomes evident and the coefficient of correlation during the whole period August-November is very high ( $-0.81$ ).

TABLE III. — *Difference between the Wheat Crop calculated from the retrogressive factor and the actual Crop (in kg. per ha.)*

Years	Estimated crop	Differing from the actual crop by	Years	Estimated crop	Differing from the actual crop by
1890. . . . .	720 kg	— 17 kg	1905. . . . .	609 kg	— 52 kg
1891. . . . .	658	+ 84	1906. . . . .	637	+ 109
1892. . . . .	824	+ 172	1907. . . . .	907	+ 2
1893. . . . .	1032	— 184	1908. . . . .	762	— 60
1894. . . . .	845	— 10	1909. . . . .	678	— 67
1895. . . . .	678	— 119	1910. . . . .	554	+ 81
1896. . . . .	304	+ 10	1911. . . . .	910	— 314
1897. . . . .	658	— 99	1912. . . . .	720	+ 17
1898. . . . .	1053	— 160	1913. . . . .	491	— 57
1899. . . . .	803	+ 48	1914. . . . .	866	— 131
1900. . . . .	637	— 35	1915. . . . .	554	+ 138
1901. . . . .	470	— 4	1916. . . . .	470	— 137
1902. . . . .	803	— 39	1917. . . . .	699	— 184
1903. . . . .	658	+ 159	1918. . . . .	762	— 48
1904. . . . .	782	+ 55	1919. . . . .	907	+ 84

In 1893 and 1898, in which years the Spring was *cold* and dry, the crop was as high as in 1919, when the Spring was *cold* and excessively rainy. Similarly, in the years when the Spring was *warm* and dry (e. g., in 1910 and 1916), the crop was as low as in those when the Spring was *warm* and wet (e. g., in 1896 and 1918).

In Argentina, therefore, the temperature is undoubtedly the most important meteorological factor from the point of view of wheat yield.

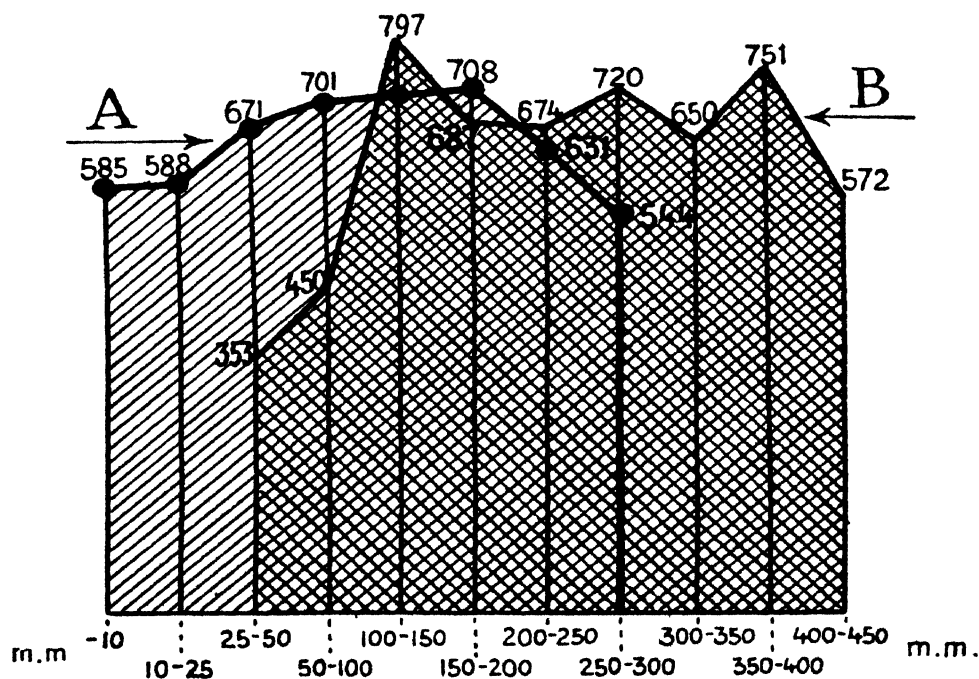
ESTIMATE OF CROP BASED ON THERMOMETRICAL OBSERVATIONS. — By using the coefficient of negative correlation between the yield and the temperature from August to November, it is possible, within certain limits, to estimate the future crop. For this purpose a constant factor must be found which, multiplied by the temperature or by the digressions from the normal, gives the yield.

This constant factor, generally called the "retrogressive factor", may be calculated by means of the formula  $b = \frac{\sum XY}{\sum X^2}$ , where  $b$  is the retrogressive factor,  $x$  the variable (in this case the temperature) and  $y$  the resulting variable (in this case the crop).

For the whole territory,  $b$  is equal to 208 for the months from August to November; if the temperature increases or decreases by *one* degree above or below the average for the above-mentioned period, there is a corresponding increase or decrease of 208 kg. of grain per ha.

Table III gives the data relating to the yield for the period 1890-1919, as estimated by the coefficient of retrogression, and the difference between the yield thus estimated and the actual yield.

*Correlation between grain yield and rain in Argentina.*



EXPLANATION.

A = average yield in kg. per ha in relation to winter rains (June-August); B = average yield in kg per ha in relation to spring rains (September-November); mm. = rainfall.

In most cases, the estimate is fairly correct. But there are exceptions among them and that of 1911 is very marked. In that year the yield, which had promised well, was damaged by the excessive rainfall of December in the last part of the period of growth. In 1895 and 1914 the same happen-



ed again. Sometimes, though more rarely, late frosts attack the crops at an advanced stage; this happened in 1908, in the middle of October.

**EFFECTS OF CLOUDINESS AND SUNSHINE ON THE WEIGHT OF THE HECTO-LITRE.** — The temperature and rain do not appear to exert any influence whatever in this respect. In the absence of data relating to hours of sunshine, the writer based his calculations on cloudiness, which is more or less in inverse ratio to the hours of sunshine. An examination of the data shows that an increase of cloudiness is attended by a decrease in weight. G. A.

1254 — **Effect on the Yield of Wheat of Variations in the Degree of Humidity of the Soil during and after the critical Period.** — AZZI G. in *Il Coltivatore*, Year LXVIII, No. 28, pp. 1-7. Casale Monferrato, Oct. 1922.

The experiments made in 1920-1921 at the Botanical Gardens of the Royal University of Rome on the Carlotta Strampelli, Apulia and Spelta varieties of wheat have fully confirmed the existence of a critical period in wheat in respect of the humidity of the soil; the period which corresponds with the period of the formation of the ear, would fall within the 30<sup>th</sup> day before and the 8<sup>th</sup> day after the formation of the ear (1).

In 1921-1922 experiments with the varieties Luigia Strampelli and Cervaro were continued at the Botanical Gardens and at the Practical School of Agriculture at Rome. From April 24 until the harvest a series of weighings of whole plants (10 at each weighing) were made at fixed intervals and the length of each plant was measured. The results are given in Table I.

TABLE I. — *Results of the experiments of 1921-1922.*

Date of determination	Cervaro		Luigia Strampelli	
	Average weight per plant (with ear)	Length	Average weight per plant (with ear)	Length
	gm.	cm.	gm.	cm.
24 April . . . . .	5.3	59	5.5	58
8 May . . . . .	6.4	78	6.5	66
15 " . . . . .	8.8	82	11.8	87
12 " . . . . .	10.5	114	9.8	100
29 " . . . . .	9.6	115	9.1	104
2 June . . . . .	9.5	118	8.7	106
5 July . . . . .	8.9	118	7.7	107
9 " . . . . .	8.2	120	7.1	117
14 " . . . . .	7.8	120	6.5	118
17 " . . . . .	6.5	120	6.3	118

The Cervaro variety formed ears from the 15<sup>th</sup> to the 22<sup>nd</sup> May; the Luigia Strampelli from the 10<sup>th</sup> to the 16<sup>th</sup>.

These data confirm the fact of the existence of a critical period as regards moisture, in relation to earing. During the period (8-22 May)

(1) See R. March 1922, No. 299. (Ed.)

the length of the stalks and the weight of the plants increase rapidly. The plant as soon as it flowers, ceases to grow and after the flowers have set grain its weight begins to decrease rapidly ; when it has reached complete maturity, its weight is less by  $\frac{2}{5}$  than the maximum at the time of forming ears, in the two varieties quoted from 10.5 to 6.5 and from 11.8 to 6.3 respectively.

These decreases in weight indicate approximately the amount of moisture accumulated to keep pace with rapid transpiration and organic development.

Pot experiments (9 series of 5 pots for each of the two varieties) were made at the same time at the Botanical Gardens, by regulating artificially the waterings in variable quantities in the different series ; the ears were formed, on the average, between May 14 and 16, flowering took place from May 20 to 23 and the plants were cut from June 19-20. The experiments may be divided into 3 groups :—

1<sup>st</sup> GROUP (series 4-10 and 14-20). — Watering was done from 5-7 days before the formation of ears until 9-10 days before cutting.

TABLE II. — Results of the experiments of the 1<sup>st</sup> group.

Number of water ings	Cervaro					Luigia Strampelli				
	Series	Number of plants	Number of stalks	Weight of grain from 5 pots	Average weight of grain from each ear	Series	Number of plants	Number of stalks	Weight of grain from 5 pots	Average weight of grain from each ear
				gm	gsm				gm	gsm
2	4	18	21	9.10	48	14	18	28	11.5	41
3	5	18	21	12.75	60	15	18	30	16.17	55
4	6	20	20	10.87	54	16	18	27	13.6	69
5	7	21	23	10.00	42	17	20	46	23.5	51
6	8	16	25	21.00	84	18	18	40	25.6	64
7	9	17	33	16.50	50	19	18	42	23.7	59
8	10	19	36	22.50	62	20	17	50	32.6	65

The increase in the number of stalks and of the yield progressed *pari passu* with the increased supply of water, but it was not possible to get the full maximum utilisation of the water.

The wheat plant was able to utilise the moisture in the soil up to 15 days after the formation of ears.

2<sup>nd</sup> GROUP (Series 3-13). -- Waterings were started at the very beginning of the formation of ears and were continued as in the preceding group. When the waterings began the plants looked sickly and the ears were scarcely out of their sheaths. Watering caused a lively and rapid reaction, but the yield was scanty and only about half that of the preceding group.

3<sup>rd</sup> GROUP (series 2-12). — Abundant waterings 10 days after the beginning of the formation of ears ; these had no effect ; most of the plants

were already dead and those which survived yielded an insignificant amount of grain.

From the results of the experiments the following conclusions may be drawn :—

1) The critical period is comprised in the interval of 15 days just before the formation of ears ; if, in that interval the moisture in the soil becomes less than the minimum amount compatible with the growth of the plants, the crop is reduced even if, during the remainder of the time, the conditions are quite favourable. If there is a large amount of moisture during the critical period, the yield will be high even if the conditions are less favourable during the remainder of the time.

2) When the soil remains dry during the critical period, waterings made when ear formation has begun cause a renewal of growth, but they are useless as regards the production of grain.

	Cervaro	Luigia Strampelli
Weight of grain from 5 pots . . . . .	5.9 gm.	6.5 gm.
Weight of grain per ear . . . . .	0.29	0.21

3) If the plants have enjoyed sufficient moisture during the critical period, they utilise waterings up to a very advanced stage of ripening. All operations made with the object of minimising the effects of drought should therefore be regulated in correspondence with the critical period, the duration of which is fairly short. A watering given too early, so that the soil remains dry during the 15 days which precede the formation of ears, and repeated at the time of flowering, has certainly less effect than a single watering given during the critical period. This fact is of great importance not only from a scientific point of view but also from the technical standpoint of the utilisation of the water.

A. de B.

1255 — **Report of the Study of the Soil of the First Egyptian Zone (Gharbija) in 1921.** —

SOIL PHYSICS

HUGHES, P., in *Ministry of Agriculture, Egypt, Technical and Scientific Service, Bulletin* No. 21, pp. 1-11, fig. 1. Cairo, 1922.

During the first half of 1921 a preliminary study was made in Egypt of zone No. 1 (Gharbija) which lies between Fariskûr and Cafr-el-Wastani and has an area of 126 km<sup>2</sup>. In these investigations, about five hundred soil samples, taken at the depths of 1-2-3 m. and 1 km. apart, were used. A mechanical analysis was made of each sample, and the soluble salts and chlorides present were determined.

The soluble salts content was not very high, being on an average between 5.82 % (at the surface) and 6.45 % (at a depth of 3 metres), the amount of sodium chloride ranged from 3.84 % to 5.40 %. Sodium carbonate was rarely present. Owing to the impermeability of the surface, the chloride could be easily removed by means of proper drainage ; this operation would be greatly facilitated by the general absence of the carbonate. The sub-soil is also impermeable, so there is little chance of

the salts being carried to the surface by water. At Kafr and Wekala, great success was attained in the reclaiming of saline land of this description.

The soil of this zone usually contains but little lime, otherwise its chemical composition is similar to that of the average Nile soils. The potassium content varies from 0.77 to 1.20 %; the phosphoric acid ranges from 0.21 to 0.32 % and the organic matter from 0.39 to 2.22 %.

A. de B.

1256 - **Report of a Study of the Soil of the Territory of the Right Bank of the Diahlah (Mesopotamia).** — WLBSTER, J. F. (Officiating Deputy Director of Agriculture (Research) and WISWATATH, B. (Assistant Government Agricultural Chemist, Bagdad), in *Department of Agriculture, Mesopotamia, Memoir No. 2*, pp. 1-20, figs. 6. Bombay 1921.

In 1920, the Agricultural Department of Mesopotamia undertook the study of all the occupied territory and investigated the region lying between the Tigris and the Diahlah, and situated between Deltawah and the confluence of the two rivers. The area of this district is over 160 000 km<sup>2</sup>. Its climate is of the Mediterranean type, the annual rainfall being 7-8 cm. and the average relative humidity ranging from 60 to 80 % in winter, and falling to 38 % in June. The water of the Diahlah, in spite of its high salts content, (0.07-0.1 %) is used for irrigation and the methods adopted are most primitive.

There are two crops in the year, one in winter and the other in summer. Barley (about 60 000 tons per annum) and wheat (some 2000 tons) are chiefly cultivated, but peas, date-palms, citrus-trees, cotton, maize, etc., are also grown. Fertilisers are only applied to gardens, and instead of making an intensive cultivation, the natives extend their crops as much as possible, in order to reduce their work to the minimum.

The soil is a calcareous alluvium. Many samples were taken at distances of 7 to 8 km. apart; 23 of these were selected for chemical analysis (determination of the soluble salts, nitrogen, carbon dioxide, potassium and calcium carbonate), while 13 were subjected to complete mechanical analysis. The soil is light and its physical conditions are good. The salt content is usually too low to have a distinctly deleterious effect. No sodium carbonate has ever been found in it.

The salts percentage is higher in the cultivated regions than elsewhere, which makes it probable that the salts are chiefly derived from the drainage-water, and not from the ascent and evaporation of the water of the subsoil.

Almost half the soil is soluble in hydrochloric acid and is composed to a large extent of the carbonates of lime and magnesium.

The phosphoric acid content is sufficiently high to render the application of all phosphatic fertilisers useless, except in the case of intensive cultivation.

All the other elements of plant nutrition are present in great abundance which makes this region remarkably suitable for agriculture.

A. de B.

1257 - **The Aeration of Soil as an Ecological Factor.** — LARS-GUNNER, R., in *Meddelanden från Statens Skogsörsöksanstalt*, Vol XIX, No 2, pp 125-359, bibliography of 24 works Stockholm, 1922

In this paper, the author discusses how far the increased deficiency of oxygen and excess of carbon dioxide caused by decreased gaseous exchange between the soil and the air are able to exercise an injurious effect and become important ecological factors.

Normally a very brisk gaseous exchange takes place between the biologically active layers of the soil and the atmosphere. The amount of carbon dioxide given off in one hour corresponds to the whole quantity contained by the soil to a depth of 20 cm. It may thus be assumed that the amount of carbon dioxide liberated is equal to that produced. On the other hand, biological activity is most intense near the surface, 68 % of the carbon dioxide being produced at a depth of less than 20 cm. Therefore a superficial layer contains all the carbon-dioxide that is produced in it in 100/68 of an hour (about 1 1/2 hour). An interruption in the gaseous exchange lasting only half-an-hour would suffice to double the excess carbon dioxide. The author therefore concludes that normal gas exchange should be chiefly determined by factors with always, when taken together, an equal intensity. If particularly variable factors such as the wind etc., were the most important, there would be more rapid and greater variations in the composition of the soil air than have been found to exist. BUCKINGHAM maintained in 1904, that diffusion was of absolutely supreme importance as compared with the atmospheric factors, but his experiments were very limited.

The author has made a quantitative experiment on the effects of the various factors. He takes as normal aeration that found in one hour at a depth of 20 cm., and examined the influence exerted by temperature, atmospheric pressure, water, wind and diffusion.

The results of his experiments proved that diffusion was the chief agent of aeration in ordinary soils and the exclusive agent in wooded soils. Aeration and the relation between oxygen and carbon dioxide depend in the first instance upon the intensity of the distribution of bacterial activity in the soil and the number of pores full of air. As regards the pores, their average air content is not of decisive importance, but the amount of air present in the superficial layer.

If  $p+$  represents excess carbon dioxide and  $p-$  deficiency of oxygen, it is seen that  $p+$  and  $p-$  are directly proportionate to bacterial activity. It this activity is equal, but differently distributed,  $p+$  and  $p-$  will be lower in a soil where bacterial action is most concentrated in the superficial layer. When the intensity and the distribution of bacterial activity are equal,  $p+$  and  $p-$  are inversely proportionate to the air content of the soil examined.

The size of the soil particles, provided their dimension is not below a minimum value, is of very secondary importance. A stratum of stiff clay gradually decreased the aeration which sometimes is reduced to 1/100 of the normal. If the pores are stopped up with water, the air present

may fall to 1/10000 of the normal amount. The activity and the air content of the superficial layers affect the  $p+$  and  $p-$  values of the lower strata. A partial blocking of the pores, or an increase in activity in a superficial layer, suffices to raise the  $p+$  and  $p-$  values of all the lower layers.

If the degree and distribution of the bacterial action and the air content of a superficial layer are known, the corresponding values of another stratum at any depth are easily calculated. In the same manner, if all but one of the values of a layer are known, the missing value can be easily determined.

As regards the ecological importance of the values  $p+$  and  $p-$ , the author states that the tolerance exhibited by plants to a deficit of oxygen and excess of carbon dioxide is very variable.  $p+$  and  $p-$  values below 2 % have no injurious effect, even if of long duration.

The complete or almost complete cessation of gaseous exchange, even if it only lasts a short time, is extremely injurious to plants possessing no special power of resistance, because it makes the absorption of water by the roots a very difficult process. Thus, under certain conditions, aeration may become an important ecological factor.

All the cases of injury due to insufficient aeration occur in soils suffering from excessive humidity or in some instances, in those containing a large amount of clay.

Soils with much humus constitute an important exception. It is certain that a deficiency in oxygen is injurious to forest trees. They cannot tolerate much water in the soil except on sloping ground where the water moves more easily. As the lack of oxygen depends upon the intensity of the gaseous exchanges and of oxygen consumption, which is a function of the temperature, it is clear that the greatest deficit will occur during the warm season. Experiment has proved that a superficial layer of humus does not hinder good aeration. DE SAUSSURE has already pointed out that roots do not suffer from excessive moisture except in so far as it induces a deficiency of oxygen and that therefore proper drainage is the best means of facilitating the access of oxygen to the roots. The researches of the author have demonstrated that drainage is the only method of providing the roots on forest land with a larger supply of oxygen, for the removal of the superficial layer of humus is of no avail, in fact, the presence of the humus may even be a good guarantee of aeration. The author gives 14 tables describing the numerous types of Swedish soils.

A. de B.

1258 - **The Effect of Soil Drying upon Soluble Soil Constituents.** — GUSTAFSON, A. P. (New York State College of Agriculture at Cornell University), in *Soil Science*, Vol. XIII, No. 3, pp. 173-213, bibliography of 106 works. Baltimore, March 1922

The fact that crops could be improved by drying the soil by means of fire was well-known to the agriculturists of ancient Rome. The beneficial effect of burning the ground was formerly attributed to the physical changes induced in the soil; it was later regarded as being due to chemical

alterations, while more recently the explanation of the phenomenon has been looked for in the re-organisation of the micro-organisms present. The improvement obtained is often too great to be attributable to mere sterilisation.

The author reviews and discusses the extensive literature on the subject. For a good many years, fire has been used to sterilise greenhouse soil and free it from injurious organisms. It has proved beneficial in these respects and has also stimulated the growth of the stems and leaves. Careful experiments have proved that the fertility of soil is increased by drying and heating to above 100° C., even if, as often occurs, germination is thereby hindered and the first stage of growth impeded. Heating increases the quantity of mineral and organic constituents that can be extracted with distilled water. The increase is nearly proportionate to the temperature reached, up to about 200° C., when the percentage of soluble substances again falls.

The investigators are not agreed as to the effect exercised upon nitrates by heating up to 100° C. Some of them maintain that nitrates decrease when the temperature is above 100° C., and totally disappear at about 250° C. Opinions also differ regarding the causes of the increase brought about in soluble substances by drying and heating. Some experts attribute the chief importance to physical factors, others to chemical factors especially to colloids, and others again to biological factors.

The author has carried out a series of most careful experiments on the question. He took samples of very varying types of soil and subjected them for 8 hours to a temperature of 105° C. Other samples were placed in the autoclave, and the experiments were made with different temperatures and pressures; while some of the soils were merely dried in the air or the sun. The amount of soluble substances was estimated by extraction with distilled water, in the ratio 1 : 5.

The percentage of soluble substances in the soil rose on drying in the air, and again on drying in the autoclave as is seen by the following Table.

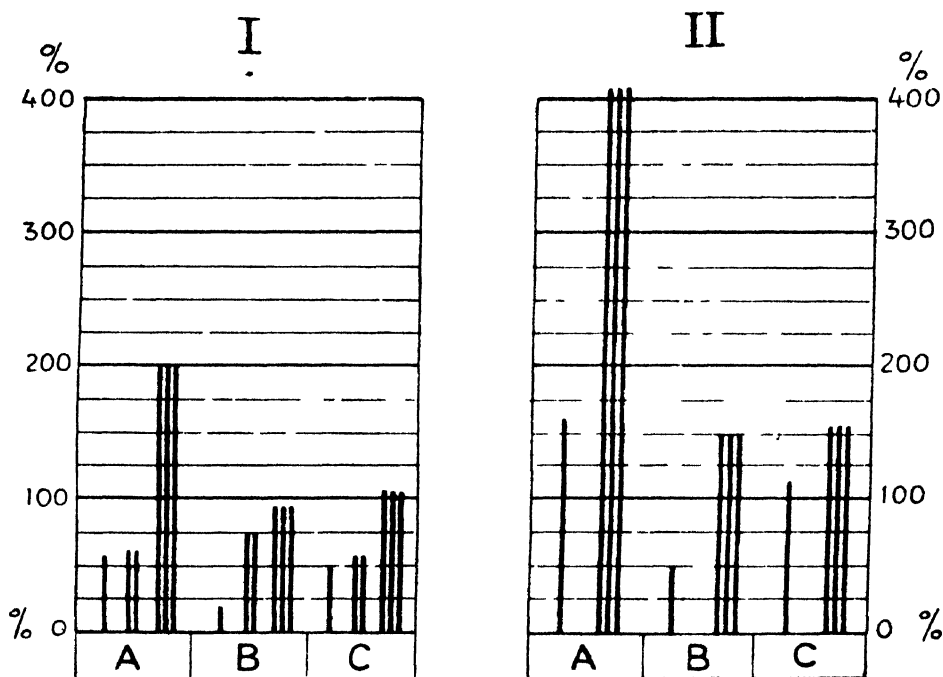
*Increase in soluble substances.*

Sandy-clay soil	Layer	Increase due to drying in autoclave (moist soil)	Increase due to drying in air (moist soil)	Increase due to drying in autoclave (air dried soil)
No. 1	Superficial, 0-12 cm. . . .	60 %	23 %	50 %
	Sub-superficial, 12-30 cm. .	62	74	59
	Sub-soil, 30-40 cm. . . .	200	94	104
No. 2	Superficial, 0-12 cm. . . .	167	50	116
	Sub-soil, 12-30 cm. . . .	412	150	154

If soil was exposed for 9 weeks at 8-12° C., in open pots (where the moisture was brought up to a constant value every week), or in

sealed tubes, there was no appreciable change in the soluble salts content. Nitrification went on regularly, whereas in general the nitrates decreased in sealed tubes.

*Soluble substances in soil dried in different ways.*



#### EXPLANATION.

I = Sandy-clay soil; II = another sandy clay soil

1st line = superficial layer; 2nd line = subsuperficial layer, 3rd line = subsoil

A = desiccation of damp soil in autoclave, B = desiccation of damp soil in air;

C = desiccation of air-dried soil in autoclave

When the soil was kept at room temperature, and at the optimum degree of moisture for 9 weeks there was an almost negligible increase in the soluble substances in the case of all the soils, except the sandy clay, in which a slight decrease was observed. If these soils were kept at the same temperature, but saturated with water, the percentage of soluble matters rose considerably. In the first instance, nitrification was active, whereas in the second, complete denitrification took place.

Heating in the autoclave always had the effect of decreasing the nitrate content of the soil.

When two different concentrations of potassium nitrate were added to 4 types of sand, the potassium salt could not be entirely recovered, even by means of 2 extractions with distilled water in the ratio 1.5. By one extraction,



67-80 % was recovered from the more dilute solution, and 77-95 % from the more concentrated.

If potassium nitrate is heated for 8 hours at 150°C. after drying, a considerable amount is lost, viz. about 10 %.

A. de B.

1259 - **Experiment on the Leaching of Nitrate Salts of Calcium, Sodium and Potassium from the Soil by Rain, in Finland.** — VALMARI J., in *Abhandlungen der Agriculturnwissenschaftlichen Gesellschaft in Finland*, No. 10, pp 75-86. Helsingfors, 1921

MAERKER calculated, by means of percolating experiments, that 100 kg. of Kainite, or other potassic salt, removed about 100 kg. of lime from the soil through exchange of bases, a fact which seriously compromised the utility of potash manures, but it appeared from experiments made in 1895, at the Station of Brême, that the quantity of lime removed was only from 8 to 24 kg., although the conditions were particularly favourable for the elimination of salts.

The problem was again taken up by H. von FEILITZEN, in Sweden in 1912, and it appeared from numerous experiments that from lyimeters without manure more nitric nitrogen and lime were removed than from those manured with potassic salts. It appeared from later experiments that the manuring influenced the removal sometimes in one sense and sometimes in the other, but always to a slight degree.

The action of potash salts on nitric nitrogen is attributed to its action on the aerobic nitrifying bacteria, whose action was gradually decreased, thus causing a decrease in the nitrates removed. An increased activity of the anaerobic bacteria (due to want of oxygen) increases the quantity of salts capable of removal. The losses of potash salts by leaching were twice as great with salts containing 37 % of potassic oxide as with Kainite. The explanation may be found in the theory of electrolytic dissociation; in fact, as the cations cannot be removed without an equivalent quantity of anions, the losses occur only in reactions which imply the formation or the destruction of anions, which largely depend on the activity of the bacteria.

A. de B.

1260 - **Experiments on the free Acidity of Mineral Soils.** — J. JESSENGANG, II., in *Die Landwirtschaftlichen Versuchs Stationen*, Vol. XCIX, Nos. 1 and 5, pp 191-220. Berlin, 1922

The author describes a series of experiments undertaken for the purpose of elucidating various points connected with soil acidity which had not hitherto been studied. Even in dilute solutions, all the acids used in the experiments (formic, lactic, sulphuric acid, etc.) set free acidity on neutral soils. It was found that the aluminium ion is practically the only factor in the exchange, for the iron ion is hardly concerned in the process. Under natural conditions therefore free acidity cannot be said to originate from any one acid, but may be the result of any of the processes causing the formation of acids in the soil.

Very dilute solutions of aluminium and of iron salts give rise to exchange acidity, but even when a 0.02 N. solution of iron salts is introduced into the soil, it is not the iron ion, but the aluminium ion that

is the active principle in the exchange. This is due to the intense hydrolysis of the ferric salts and the consequent adsorption of the iron in the hydroxide condition, just as when ferric chloride is used, the action upon the soil is exerted by the hydrochloric acid and not by the iron ion.

Relatively small quantities of quite dilute solutions of carbon dioxide, very similar to those that may be found in the soil, also have the power of rapidly rendering a soil acid; this proves how much carbon dioxide has to do with soil acidity.

An intense degree of acidity can also be produced in aluminium silicate (the permutite of GANS), but only by means of carbon dioxide. All other substances produce precipitates that would decompose the permutite.

On the other hand, the action of acids and salts only produces a slight acidity in analcim; this perhaps may be explained by the fact that analcim differs greatly in structure from aluminium silicates. The author confirms the data obtained by GANS respecting molecular relations in soils, and taking as his basis GANS's views of the composition of aluminium silicate suggests a chemical formula for this compound.

After having demonstrated the impossibility of employing the colorimetric method for the determination of the amount of time necessary for the neutralisation of exchange acidity, the author states that in his opinion the best method for the purpose is that devised by PACKUCHARA which is based on the determination of the total acidity. A. de B.

1261 - **Clark's Hydrogen Electrode Apparatus and its Determinations of the Concentration of the Hydrogen Ions in the Soil.** — ITALY, D. J., and HARRAKER, P. E., in *Soil Science*, Vol. XIII, No. 5, pp. 323-328, bibliography of 4 works. Baltimore, May 1922.

After giving an account of the various colorimetric and electric methods for the determination of hydrogen in concentration, the authors describe a new apparatus constructed according to CLARK's specification which is easily handled and estimates the Ph value to 2 decimal places. Numerous trials have been made to test the accuracy of the machine, and the results obtained were entirely satisfactory. Higher values are given for air-dried soil by this apparatus than by WHERRY's method. A. de B.

1262 - **Possible Correlation between the Fertility of Soils under Rice and their Titration Curves.** — ARRHENIUS, O., in *Soil Science*, Vol. XIV, No. 1, pp. 21-26, bibliography of 7 works. Baltimore, July 1922.

In Java as generally in the East the rice crops are of paramount importance, since rice constitutes the staple food of the natives. Owing to the great increase of the population, the amount at present grown fails to supply the demand and every effort is being made to improve the existing rice-fields and to plant new ones.

The rice crop in Java varies between 250 and 400 kg. per hectare, with an average of 1000 kg. per hectare.

The author had determined the pH values of many different soils without finding any constant relation between these values and soil fer-

tility. He found however that there was a constant correlation between the titration curves of soils and their buffer action, those being the most productive which possessed the highest intercepting property.

Plants secrete carbon dioxide and other substances that act as amphoteric electrolytes *i. e.* behave both as acids and as bases. The decaying parts of the plant behave in the same manner. If 14 rice plants are placed in nutrient solutions with a pH ranging from 3 to 9, it is found after 2 days that all the solutions have the same pH value, 6.2; for they have been neutralised to this specific point by the sap of the plant. Rice acidifies the soil, and if the soil possesses a slight degree of buffer action, the pH value undergoes considerable alteration. The rice plant does not grow well in very acid soils; hence the crops grown on soils rich in humus are nearly always unsatisfactory unless lime is introduced, when green manure and other substances with a high humus content can be applied with excellent results.

Soil acidity is also most injurious from another standpoint. Aluminium salts, which are toxic to the rice plant, are precipitated by neutral solutions but are soluble in acid solutions.

The application of lime may prove an effective remedy, but for very acid soil at least 2.5 tons per hectare would be required. In any case, to obtain a durable result it would be necessary to add some substance with a good buffer action, the best and cheapest being a good green manure.

A. de B.

1263 - **The Effect of the Magnesium and Calcium in Limestone upon the Chemical Composition of the Soil and on Plant Behaviour.** — MATHER, W (Rhode Island Agricultural Experiment Station), in *Soil Science*, Vol XIII, No 5, pp 337-354, bibliography of 25 works. Baltimore, May 1922.

One of the most complex agricultural problems is the question of the action of calcium and magnesium; its speedy solution seems improbable, although much work has already been done with the object of throwing light upon the question. The author describes some experiments on a sandy clay soil which were begun in 1919 and continued for 11 years. Three applications were made of slaked lime (calcic and magnesian) and of ground calcic and magnesian limestone. The results obtained from the experiment fields thus treated were carefully tested and slight differences corresponding to the several forms of the fertiliser employed were found to exist.

Both the slaked lime and the limestone, whether calcic or magnesian, have equal power for neutralising soil acidity, if they are applied in equivalent amounts; this was proved by titration. They both render the aluminium in the soil relatively insoluble. When magnesian limestone is used, the proportion of lime and magnesium in the soil tends to remain the same as it was before the treatment.

The flora was not affected by the variable ratios between the oxides of calcium and magnesium, but showed itself very susceptible to the soil reaction.

Magnesian limestone is inclined to increase the nitrogen content of

the soil. Slaked lime, both calcic and magnesian, has so far caused no fall in the nitrogen percentage, but has slightly decreased the amount of organic matter present.

A. de B.

1264 - **Distribution of the Phosphorus Ion in the upper Layers of the Soil in Relation to Vegetation and the Addition of various Salts.** — LEONCINI, G., and ROGAI, F. A., in *L' Agricoltura Italiana*, Year XI, V, Nos. 4-6, pp. 100-124. Pisa, 1922.

The phosphorus ion rapidly becomes fixed in the soil, so that after the application of phosphatic fertilisers, it often happens that phosphorus is only found in the upper layers. In this connection, mention should be made of the experiments made at the Pusa Experiment Station, and by J. T. CRAWLEY and K. S. KAPIZOY. CRAWLEY found that if soil was irrigated immediately after being dressed with a phosphatic fertiliser more than half the phosphoric acid was fixed in the 2.5 first centimetres and  $\frac{9}{10}$  in the 7 first centimetres, little being found below the depth of 15 centimetres. When the irrigation was deferred for 15 hours, the phenomenon was still more accentuated, all the phosphoric acid being practically fixed in the first 7.2 centimetres.

Experiments have been undertaken to ascertain the effect exerted by vegetation or the addition of soluble salts upon this adsorption. It appears that their action generally renders the distribution of the phosphorus ion more uniform, and hence causes it to penetrate more deeply into the soil; they also increase the power of the soil for fixing soluble phosphates. S. SKALKIS, T. E. GREAVES and F. G. GARTER have carried out experiments on the same subject.

The authors have also taken up the study of this question. They used a wooden parallelepiped made of 10 superimposed frames each 3 cm. high that touched one another and could be removed and isolated. The apparatus was filled with 7.200 kg. of sifted soil. Two series were made each with 5 sets of frames. One series was carried out without plants, in the other two maize plants were used. The surface of each box was sprinkled over with 4 gm. of very finely powdered dicalcic phosphate. To 4 boxes of each series were also added equi-molecular quantities of different salts, viz., ammonium sulphate, sodium sulphate, ammonium nitrate and sodium nitrate, phosphate alone being added to the fifth box. As soon as they began to flower, the plants were cut to the level of the soil, the different layers of soil were separated and analysed.

The authors confirmed the statement that phosphate is chiefly fixed in the upper layers of the soil. They found that the presence of vegetation makes the distribution of phosphorus more uniform by reducing the number of phosphorus ions in the upper strata and increasing them in the lower. Thus in the three boxes to which phosphorus only was added, the box without plants was found on analysis to contain 5.42 per 1000 in the top layer and 2.06 per 1000 in the tenth, whereas the numbers of phosphorus ions in the boxes with maize were respectively 5.03 and 2.35 per 1000; the difference is not great, but it is appreciable.

The salts had the same effect as the vegetation, but vegetation in pre-

sence of the salts increased the attraction of the soil for phosphates. Thus with sodium sulphate in the box without plants, the figures were 4.80 and 2.19, as against 4.92 and 2.38 in the box containing plants. The behaviour of ammonium sulphate was somewhat different: 5.99 and 2.44 as against 5.57 and 2.48. As a rule, vegetation in the presence of soluble salts, instead of stimulating the descent of the phosphorus ions causes them to become fixed in greater numbers in the upper layers.

The authors also tried to determine the effect of the anions with unvaried cation and reciprocally, but the differences were neither large nor constant. Thus the ammonium ion, if added under the form of phosphate, promotes the descent of the phosphorus ion, whereas if added under the form of nitrate, it has the contrary effect; the behaviour of the sodium ion is just the reverse.

L. V.

1265 - **The Oxidation of the Sulphur in Alkaline Soils.** — RUDOLFS, W (New Jersey Agricultural Experiment Station-), in *Soil Science*, Vol XIII, No 3, pp 215-229, fig 1, bibliography of 7 works Baltimore, March 1922

In 1916 LIPMAN recommended the application of sulphuric acid or sulphur to soils containing sodium carbonate for the purpose of transforming this toxic salt into sodium sulphate and thus rendering fertile many regions that were wholly unproductive.

The results obtained by LIPMAN and SHARP from their experiments in this direction, though fairly satisfactory, did not warrant the adoption of this method.

From his own experiments on two samples of sandy-clay containing sodium carbonate, the author was able to draw the following conclusions:

By the inoculation of sulphur, and consequent formation of sulphates, the soil seems to acquire new physical properties among which are more complete flocculation, a change in its water-containing capacity and in its apparent specific gravity.

In soils containing little sodium carbonate, small quantities of sulphur have no effect upon the pH value though a large amount brings about decided changes which were almost the same in an incubator at 28° C. and with the optimum degree of moisture as in a regularly watered greenhouse.

Soils that had been previously washed were more quickly neutralised by the addition of sulphur than unleached soils, as was proved by acid tests and the determination of the pH. After 18 weeks the sulphur was practically oxidised in all the cultures. When the oxidation of the sulphur increased, the carbonates were transformed into bicarbonates.

The author observed a strict correlation between the formation of sulphate, the flocculation and the apparent specific gravity of the soils whether leached or unleached. The formation of sulphates seemed to cause the sodium carbonate and the sample of sandy-clay to aggregate which produced a change in the water-holding capacity of the clay.

The microflora, as represented by the number of colonies that made their appearance on the agar plates, varied in proportion to the pH. The

cultures in the unwashed soils inoculated with a sufficient amount of sulphur to neutralise their alkalinity produced, after 12 weeks' incubation, 5 times as many colonies as those in the untreated soils, and the cultures of the washed soils produced 3 to 5 times more colonies than the corresponding untreated cultures.

In cultures of washed soils, which after the addition of sulphur, had nearly the neutral value of pH, there appeared relatively few colonies of moulds and actinomycetes, whereas the cultures on the agar plates inoculated with unwashed soil were almost entirely composed of colonies of moulds and actinomycetes.

Barley-seed germinated and grew with great rapidity in alkaline soils inoculated with sulphur, but the seedlings were always killed by the saline crusts on the surface of the soil which were dissolved when the pots were watered, but the water only penetrated very slowly into the soil owing to its bad physical condition.

A. de B.

1266 - **Bacteria connected with the Oxidation of Sulphur in the Soil: Media used for the Isolation of Sulphur Bacteria from the Soil.** — WAKSMAN, S. A., in *Soil Science*, Vol. XIII, No. 5, pp. 329-335, bibliography of 17 publications. Baltimore, May 1922.

It has been known for a long time that sulphur can be oxidised by various groups of bacteria which draw their energy from it instead of from carbon compounds. These bacteria may be divided into three groups according to their physiological characteristics:

I) *Sulphide Bacteria*, which oxidise especially sulphuretted hydrogen and sulphides, and which may be subdivided into 3 species:

a) colourless bacteria, producing threads, which accumulate the sulphur in their cells,

b) colourless bacteria, not producing threads,

c) purple bacteria.

II) *Thiosulphate Bacteria* on thionic acid, which especially oxidise thiosulphates and, partially, sulphides and pure sulphur.

III) *Sulphur Bacteria*, which oxidise free sulphur and, differing from the two former groups, do not accumulate sulphur in their cells but produce a large amount of sulphuric acid.

The bacteria of the I<sup>st</sup> group (a, b, c.) belong for the most part to the *Thiobacteriales*; those of the II<sup>nd</sup> and III<sup>rd</sup> groups belong to the genus *Thiobacillus*.

Another classification might be based on the optimum reaction of the activity of the organism; the first two groups have the optimum on the alkaline side, the third on the acid side.

The writer next describes 9 media, which he used for isolating the organisms which oxidise sulphur, of which 3 were discovered by the writer himself, and he gives their chemical composition.

A. de B.

1267 - **Biochemical Methods for Determining the Fertility of Soils.** — STOKLASA, J., in *Chemiker-Zeitung*, Vol. XLVI, No. 91, pp. 681-683 Cöthen, Aug. 1. 1922.

In 1 ha. of soil, from the surface to a depth of 40 cm., there are from 200 to 400 kg. of bacteria, and among these the total of live bacteria is as much as about 10 quintals. This mass may exert a decided influence on the fertility of the soil. The following groups of organisms live in field soil: 1) bacteria — 2) mycetes — 3) algae — 4) protozoa — 5) rotifera — 6) oligochetes — 7) nematodes — 8) euchitriodes — 9) tardigrades — 10) arachnidae — 11) insects — 12) molluscs — 13) mammals. H. FRANCE proposed, in 1912, to give the name of "edaphon" to the whole of these soil organisms which live together like the plancton in the soil.

To sustain life, all these organisms need: oxygen, hydrogen, carbon, nitrogen, phosphorus, sulphur, chlorine, silicon and manganese. In the case of the heterotrophic organisms carbon can only be assimilated in an organic form, hence the great importance of organic matter to the life of the "edaphon". Oxygen and water are equally essential; the various organisms in the soil really strive for water, hence it is fundamentally necessary to determine the water and air capacity of a soil in order to make a biochemical study of it.

The ratio of oxygen to carbon in a soil indicates the ratio of aerobic organisms to anaerobic; their condition is also influenced by partial pressure of oxygen, the absence of which is detrimental to the process of assimilation and causes an intermolecular respiration of the roots.

Soil reaction is likewise very important, not only from the physiological, but also from the phytopathological point of view. The concentration of hydrogen-ions has a great influence on the absorption of nutritive substances; soils with an alkaline or neutral reaction absorb much more vigorously than acid soils.

From the biological point of view, the germ content is of the utmost importance: and not only the colonies of bacteria, but also various species of fungi, and algae. The greater number of micro-organisms are concentrated in the upper layer of 10-25 cm.; beyond a depth of 40 cm., their number rapidly decreases; the true germ content is, according to the vegetation, from 28-87 millions (in a field of oats) to 80-120 millions (in a clover field) per quintal of dry soil; in forest land, 15-26 millions which decreases to 5-9 millions in acid zones; and in pasture land it is 6-10 millions.

The microflora of the soil, which has so great an influence on fertility, needs elements in a form which renders them capable of being easily assimilated, and especially carbon, which forms 44-45 % of their substance.

The bacteria of the soil are divided into autotrophic, which may form carbon and proteins hydrates from carbonic acid and mineral salts, and heterotrophic, which assimilate carbon and nitrogen only in an organic form. In soils whose air content is less than 2 %, the anaerobic processes of the autotrophs are in the ascendant. The activity of the aerobic bacteria and the facility with which the organic matters of the soil which

nourishes them are decomposed are shown by the quantity of carbonic acid which forms in the soil, after the elimination of certain factors.

The long researches by ERNEST and STOKLASA have shown that the respiration of autotrophic and heterotrophic bacteria depends on the water and air content of the soil, on its composition, the facility with which the organic matters are decomposed, reaction, manuring, tillage and culture of this soil. The quantity of carbonic anhydride produced is from 8 mgm. (sterile soil) to 68 mgm. (soil under beets) per kg. per day. Below a depth of 80 cm. only traces are found.

It may be estimated that a production of 30 mgm. of carbonic anhydride per kg. of soil at a depth of 36 cm. corresponds per ha. to 150 kg. per day and 300 quintals or 30 millions litres for 200 days of the year, the liberation of this gas largely helps to render the soil porous and also raises the temperature 1 or 2 degrees. The carbonic acid formed transforms the insoluble di-, tri- and tetraphosphates into soluble phosphoric acid and also renders the calcium, potash and magnesium salts soluble. Another very important consequence of bacterial respiration is the transformation of the cations of the soil into bicarbonates, which possess an essential nutritive and regulating function; in addition to metals, they furnish plants with a certain quantity of carbonic anhydride. Plants also have special organs on the under surface of the leaves for receiving the carbonic anhydride which emanates from the soil. If a concentration of 0.1-0.25 % of carbonic anhydride in the air increases the yield of certain plants by 200 %, the same result may also be obtained by supplying the roots with anhydride in the form of bicarbonate.

It is therefore of great importance to be able to increase the bacterial production of carbonic anhydride; the mode of procedure can only be indicated by a biochemical examination of the soil. The radio-activity of soils is also very important; it has a powerful influence on the activity of microflora and macroflora; the most radioactive soils are the granite soils ( $2.58 \times 10^{-12}$  gm. of radium per kg.); and generally, sedimentary soils are less radioactive than volcanic soils.

Radioactivity stimulates to an extraordinary degree the processes of assimilation and dissassimilation by bacteria. A radioactivity in the air of 30 M F. (or 0.000011 mgm. of radium) suffices to increase by 60 %-130% bacterial respiration and the inherent processes such as formation of carbonic anhydride, heating, etc. Nitrifying bacteria are also rendered highly active by it. The close connection between radioactivity and soil fertility therefore becomes more and more evident. A. de B.

1268 - **The Effect of the Application of various Salts upon the Nitrogen-Fixing Properties of Soil.** — GREAVES, J. T., CARTER, T. G., and LUND, J., in *Soil Science*, Vol. XIII, No. 6, pp. 481-499, bibliography of 51 works, Baltimore, June 1922.

The authors after having studied the ammonification and nitrification of a calcareous clay, now describe a series of experiments on the nitrogen-fixing capacity of the same soil, the methods adopted being those previously used. A large number of 100 gm. soil samples were analysed and placed



in sterilised test-tubes the same amount of lactose, and different quantities of the various salts used in the experiment being added in each case. The humidity was brought up to 18 %, and the samples incubated at 28°-30° C. for 3 weeks. The amount of nitrogen was then estimated by taking the average of at least 4 determinations.

The authors employed in their experiments: the chlorides, nitrates, sulphates and carbonates of sodium, potassium, calcium, magnesium, manganese and iron. The results obtained led them to adopt the following conclusions:

The toxicity of the salts used depends upon the nitrogen fixation of the given salt, and not on the negative electro ion as in the case of the ammonifying bacteria. In this respect nitrogen-fixing bacteria resemble nitrifying bacteria. In the soil chosen for the experiment, the salts proved less toxic to the nitrogen-fixing bacteria than to the nitrifying and ammonifying bacteria.

The amount of a salt that can be introduced into a soil without hindering nitrogen-fixation varies according to the salts. The proportions below which some of the salts proved innocuous were as follows:— Sodium salts, 1 part in 400 million parts of soil; calcium nitrate, sulphate and carbonate, 1 part in 400 million parts of soil, magnesium chloride and sulphate 243, manganese nitrate 550; ferric chloride 272.

The other salts became toxic in certain proportions in the following order:

- |                        |                        |
|------------------------|------------------------|
| 1) Magnesium carbonate | 8) Calcium chloride    |
| 2) Magnesium nitrate   | 9) Manganese chloride  |
| 3) Potassium carbonate | 10) Potassium chloride |
| 4) Iron carbonate      | 11) Potassium sulphate |
| 5) Manganese carbonate | 12) Potassium nitrate  |
| 6) Iron nitrate        | 13) Manganese sulphate |
| 7) Iron sulphate       |                        |

None of the potassium chloride and carbonate concentration used in the experiment stimulated nitrogen fixation. The other salts, especially calcium, nitrate, sodium carbonate and potassium sulphate, increased it in varying degrees.

When the soil is not acid, the alkaline constituents hinder ammonification and nitrification much sooner than they retard nitrogen fixation.

A. de B.

1269 - **The Agricultural Value of Sea-sand.** — BORTASE, V. and GREGG, A., in *Journal of the Ministry of Agriculture*, Vol. XXXI, No 7, pp 591-599 London, October 1922.

MANURES  
AND  
MANURING

It has long been customary in Cornwall to dress the land with sea-sand which contains a large proportion of calcium carbonate derived from the shells of marine molluscs.

In this district, the wind carries inland the sand from the beach and piles it up into dunes often fifteen metres in height and covering vast areas. Large quantities of this sand have been used for agricultural purposes for

many centuries. At one time it was considered that the sand had no value, but it has been used in increasing quantities during the last 20 years, its low price causing it to be preferred to lime. The seasand is applied alone, or more often mixed with straw, dung, or some other natural fertiliser, usually at the rate of 10 to 15 tons per hectare, although sometimes twice the amount is used.

As the calcium carbonate content of the sand ranges from 2 to 84 %, its calcium oxide percentage varies from 4.5 to 47 %. The sand contains no other substance of agricultural value, sodium chloride being present only in negligible quantities (0.002-0.03 % in dry sand, and 0.1-0.78 % in damp sand). As the sand can be obtained for almost nothing, the cost of the lime it contains depends entirely on transport. Slaked lime is much more available than ground limestone or sand; while ground limestone being a little finer than this sand is slightly more readily assimilated by plants. The relative prices of the different substances vary according to the locality. At Truro, one of the largest industrial centres, one ton of calcium oxide costs 45 shillings in the form of slaked lime, 71 shillings as ground limestone, and 20 shillings as sand.

Numerous experiments have been made to determine the manurial value of seasand. In 1920, three meadows were fertilised respectively with the three forms of lime associated with phosphates, potassium and ammonium sulphate. All three meadows did well, but the one manured with sand was superior to the others.

In other experiments conducted at Rochelle, the plots to which lime had been applied were distinguished by the clover growth and the small number of weeds present, whereas the other plots were infested with weeds. The plot that had received sand (4.06 tons at £1 12s. was equal or superior to the others to which respectively 2.03 tons of ground limestone at £3 10s, and  $\frac{1}{2}$  ton slaked lime at £1.13s. had been applied. The prices of the sand and of the slaked lime were thus about equal, but 8 times more of the sand were required.

Amongst farmers there is a considerable consensus of opinion in favour of seasand. As a rule it produces a considerable increase in the clover yield, and cattle show a decided preference for pastures that have been so treated. In districts near the sea-coast, the application of sand is less profitable, because the soil has already received much of the lime it needs without any cost of transport. Many farmers have observed that whereas all forms of lime are injurious to oats, seasand has proved the most harmful. On the other hand it does much less harm to beets than lime which is generally applied to this crop. As the soils in Cornwall are already light, the addition of seasand has little mechanical effect and its agricultural importance depends upon the general deficiency of lime in these acid soils and the fact that slaked lime has to come from a distance.

The author recommends the study of the many seaside districts of England that are rich in sand with a view to the possible working of this source of lime.

A. de B.

1270 - **The Effect of the continuous Application of Chemical Fertilisers upon Soil Reaction.** — BURGESS, P. S., in *Agricultural Experiment Station of the Rhode Island State, College Bulletin* 139, pp. 3-35, bibliography of 22 works. Kingston, Rhode Island April 1922.

The author describes a series of experiments undertaken with the object of determining the effect of different fertilisers upon the reaction of the soil. These experiments were conducted at the Rhode Island Experiment Station where there are many plots under the same conditions and occupying an extensive area of sandy-clay which were eminently suitable for the purpose. Samples of soil were analysed every 4 or 5 weeks from May to September 1921; they were taken near the surface (10 cm.), 12 to 26 borings being made for plot. The hydrogen ion concentration was determined in each case by HILDEBRAND'S electrometric method, and the lime requirement by JONES' calcium acetate method.

The following conclusions can be deduced from the results obtained:

Basic slags, superphosphates, bone-manure and mineral phosphate waste all help to decrease soil acidity, as was shown by the comparison of the treated and untreated plots respectively. The three first fertilisers proved the most active in this direction. There is thus no foundation for the common opinion that the continued use of superphosphates renders soils acid.

Finely-ground fish-guano and sodium nitrate perceptibly diminish soil acidity, whereas dried blood, decomposed fish, ground hoofs and offal from the abattoirs and poulterers increase the acidity slowly but steadily. Ammonium sulphate has always been found to increase soil acidity more than any other nitrogenous fertiliser.

All the potassium salts slightly diminished the acidity of the soil, kainit being the most active; next come the chloride and sulphate of potassium although there is a little difference in their influence. The carbonates of sodium and potassium have much more effect than the chlorides of these elements in reducing acidity and, calculating the oxide equivalent, are twice as effective as lime fertilisers.

Soil acidity is slightly lowered by the application of a green manure composed of non-leguminous plants, but is raised by the ploughing in of a leguminous crop; this is perhaps to be attributed to the fixation of the nitrogen contained in the leguminosae.

Other factors besides fertilisers are naturally concerned in influencing the soil reaction, of these the chief are the type of soil and the nature of the crop. They must all be taken into account before any general laws can be formulated.

A. de B.

1271 - **Manuring Fish Ponds: Exchange of Bases in the Soil.** — MEHRING H., in *Fischerei-Zeitung*, Vol. XXV, No. 27, pp. 297-299. Neudamm, July 2, 1922.

In a soil, exchange of bases always takes place when there is an active substance in excess. The following is a characteristic example:— if lime is spread in excess on a field rich in potassic minerals, e. g. mica, potash is displaced and exerts its fertilising action; in a soil of this kind manuring on a lime basis is equivalent to potassic manuring. But if as a result

of an immediate success, too much lime is added, it displaces the potassium in the form of hydrate or bicarbonate in larger quantity than the plants can absorb, and the excess of potash is carried away by rain. If this process is repeated the soil becomes poor in potash to such a degree as to become sterile, as has happened in certain places. Gypsum may have the same effect.

These considerations are applicable to the problem of manuring fish ponds. The formation of a reed bed is a certain indication of impoverishment of the soil; if this impoverishment is very marked, horse-tail shows itself. Using lime as a remedy against the reeds only increases the evil, as still more potash is removed from the soil. Manuring with 50 kg. of basic slag, 75 kg. of kainite and 150 kg. of marl causes the horse-tail to disappear. The reeds when once rooted out are prevented from returning by a strongly potassic manuring. It is always best to give a complete manuring on the basis of phosphoric acid, lime and potash: but an excess of lime, already given in the basic slag, should be avoided and if necessary corrected with potash.

A. de B.

1272 - **Waste Water from Wool-Washing, as a Source of Fertiliser.** — VEITCH, I. P., (Bureau of Chemistry, U. S. Department of Agriculture, Washington), in *The Journal of Industrial and Engineering Chemistry*, Vol. XIV, p. 434, Washington, May 1922.

The United States annually consume over 275 000 quintals of unwashed wool. About a half is composed of various impurities, salts, fatty substances and other albuminous matters that must be carefully removed. With the exception of the fats, these foreign substances are all thrown into the rivers where they contaminate the water. Wool in the yolk contains: 6 to 42 % fatty matters (average 14 %); 6 to 33 % (average 14 %) water-soluble substances; 0.3 to 0.11 % (average 0.6 %) nitrogen (in addition to the amount entering into the composition of the wool); 1 to 7 % (average 4 %) potassium. At the present time in the United States an amount of potassium corresponding to 100 000 tons of kainit, and worth 840 000 dollars are annually thrown away.

Numerous attempts have been made to recover the potassium salts and other matters, but apparently without success, except in the case of the small percentage of fat present. This problem should however be further studied and all the more since many States insist upon the wool factories purifying their waste water before turning it into the rivers. This entails heavy expense for which no compensation is obtained by the utilisation of the products recovered.

The Bureau of Chemistry of the Department of Agriculture has just begun experiments on a large scale in order to turn these waste substances to good account.

The concentrated washing water contains 42 % water, 14 % potassium oxide, 1.25 % nitrogen and 14 % fatty matters. The dried fat-free residuum contains 24.5 % potassium oxide, 25.5 % nitrogen and 0.6 % fat.

The fertilisers are made by mixing these residua with the waste products of other industries. They contain 6.5 % soluble potassium oxide, 6.1 %

total nitrogen, 3.4 % water-soluble nitrogen and 6.8 % fatty substances. These fertilisers are in excellent mechanical and hygroscopic condition and are easily handled.

A. de B.

1273 - **Influence of Humic Acids on the Assimilation of Phosphoric Acid.** — MACK, K., in *Chemiker Zeitung*, Year XLVI, No. 9, pp. 73-75. Cöthen, January 1922.

Phosphoric acid is found in the soil in the form of primary, secondary and tertiary phosphates of alkaline, alkaline-earth metals, aluminium, iron and manganese; and it is perhaps also present as a tetraphosphate of alkaline-earth metals, aluminium, iron and manganese. The water of the soil which contains phosphated ions becomes separated from the insoluble phosphates through the action of calcium-, magnesium-, aluminium- and iron-hydrates, magnesium- and iron-carbonates and certain silicates. Through the activity of soil bacteria, which, during respiration, produce carbonic anhydride and, in disintegrating organic substances, produce acetic-, lactic-, butyric- and valeric-acids, the insoluble phosphates become partly soluble again. Further, in soils rich in organic substances a large quantity of humic acids are formed which render the phosphates soluble. Phosphoric acid is found in the soil not only in a mineral state but also in the form of organic compounds such as phosphatids (lecithin), phytine and nucleoproteids, as is shown by the works of STOKLASA and other writers. These organic combinations are due to the remains of plants incorporated in the soil (stubble, roots, etc.). STOKLASA observed that the phosphoric acid combinations found in the soil are much more energetically assimilated, under the action of bacteria, than pure insoluble phosphates. He was also led to conclude that the soil contains other forms of phosphates than those recognised hitherto, notably easily-assimilated humophosphates (1).

The writer has made a series of experiments with the object of determining the effect of humic acids on the various phosphates. The acid used was extracted from peat, which was treated with sulphuric acid to separate the alkaline humates: 10 gm. of pulverised "humic" acid were added to a quantity of phosphate corresponding to  $\frac{1}{100}$  molecular-gram of phosphoric acid and the whole was left for 48 hours in 1 litre of water, and was frequently stirred. The results proved that humic acids render soluble the following quantities of phosphate, expressed in % of phosphoric anhydride: 29.45 % of dicalcic phosphate, 28.46 % of tricalcic phosphate, 12.54 % of tertiary aluminium phosphate and 7.46 % of tertiary iron phosphate. Humic acids therefore act on insoluble phosphates as dissolvents. A remarkable fact is that they act on dicalcic phosphate in the same way as on tricalcic phosphate.

Humic acids act differently when alkalis are present. Thus, humate

(1) On the subject of "humophosphates" and humous matter and manures in general, see the interesting works of Prof. J. DUMONT (of Grignon), published under the titles of *Les matières humiques du sol* and *Les engrais humiques*. Paris, Charles Amat (publisher), 1909. (Reviewer's note)

of ammonia renders soluble less tricalcic phosphate than in the former case (23.08 %  $P_2O_5$  as against 28.46 %), but, on the other hand, much more tertiary aluminium phosphate (23.77 % as against 12.54 %) and tertiary iron phosphate (20.37 % as against 7.46 %).

With metallic oxides, humic acids and humates are capable of forming complex combinations, containing the metal in the anion. Thus, ammonium humate may combine with aluminium and iron phosphates to form compounds containing, besides iron and aluminium, phosphoric acid, otherwise known as salts of a "humosphosphoferric" acid and a "humosphosphoaluminic" acid. Pure humosphosphoferric acid has been isolated, it is a bituminous, blackish-brown substance, soluble in alcohol up to 2.65 %.

To determine the action of humic substances in the presence of insoluble phosphates, experiments were made on different kinds of soil which were well washed until completely free from phosphoric acid and of which an extract was afterwards made with 0.5 % ammoniac.

From 100 gm of forest soil containing 0.095 % of phosphoric anhydride, an ammoniacal extract was obtained of which the ash contained

Phosphoric anhydride	0.0488 gm, corresponding to 51.37 % of the total anhydride
Sesquioxide of iron	0.0430 "
Alumina	0.0192 "
Lime	0.0113 "

In a soil rich in bone and lime phosphates only 3.5 % of phosphoric anhydride were found to be present, which agrees with the fact that marshy soils rich in lime are not very fertile. From a garden rich in mineral and organic fertiliser, 25.27 % of anhydride were obtained.

The excess of bases over phosphoric acid shows that the latter is present especially as a basic phosphate. In soils with an alkaline reaction, aluminium and iron phosphates are combined with the humic basis, which explains their greater fertility.

Humosphosphoferric and humosphosphoaluminium acids therefore serve to supply plants with phosphoric acid and perhaps with iron and aluminium in a form which can be easily assimilated. This was fully confirmed in a series of experiments in which beets were cultivated in various nutritive solutions, of which some were exclusively mineral while others contained humate of ammonia. After 18 days, there was still considerable quantity of phosphoric acid in the first solutions, while the second contained no further traces. Other experiments are being made, but already in practice preparations of peat and ashes used as fertilisers, and the addition of iron hydrate to the ordinary fertilisers have given good results.

The writer concludes by saying that greater importance should be attached to raw phosphates containing oxide of iron, such as those of Bavaria and the Hartz mountains, he is not in favour of the use of superphosphates, which eventually render the soil too acid. The use of manure, on the other hand, should be widely developed. In regions where, from climatic or economic reasons, it is impossible to rear livestock,

peat might be employed with advantage, for it not only renders phosphoric acid assimilable, but also furnishes nitrogen and it is a good medium for bacteria, which thus increase the carbonic acid of the soil. A. de B.

1274 - **The Agricultural Value of the insoluble mineral Phosphates of Aluminium, Iron and Calcium.** — MARAIS, J S (University of Illinois), in *Soil Science*, Vol XIII, No. 5, pp. 355-409, 5 pl apart from the text, bibliography of 85 works. Baltimore, May 1922.

The great demand for phosphates and their high price recently suggested the idea of using for agricultural purposes the deposits of iron and aluminium phosphates. In spite of the many satisfactory results already obtained, the opinion that the value of these phosphates is practically negligible is still very widely held, even by experts. The author reviews the extensive bibliography of the subject and gives an account of a series of experiments made with a view of comparing the phosphates of iron and aluminium with those of calcium. The aluminium phosphates used were lazulite, wavellite and Sadanha, a South African phosphate; the iron phosphates, dwfrenite and vivianite; and the calcium phosphates, the crude phosphates of Florida and South Africa. All the aluminium phosphates are basic; lazulite is completely insoluble in acids, and even after half an hour's treatment with hot aqua regis only yields traces of phosphorus anhydride. Wavellite and Sadanha phosphate dissolve readily in acids.

Five experiments were carried out: a) to compare the effects of the different phosphates; b) to try the effect of phosphates in sand cultures; c) to determine the influence exerted by the nitrification of urea upon the availability of the different phosphates in the soil and in sand cultures; d) to determine the availability of chemically pure phosphates of calcium, iron and aluminium and the effect of calcination; e) to determine the other factors influencing the availability of insoluble phosphates.

The author's conclusions are as follows: the mineral phosphates of aluminium and iron are good sources of phosphoric anhydride for plants; under certain conditions, but not always, they are also superior to calcium phosphate.

The nitrification of urea and the resulting production of acids have a very beneficial effect, as they materially assist plants in assimilating the phosphates of aluminium, iron and calcium which serve them for food.

Chemically pure phosphates of aluminium and iron can be assimilated by plants with the same facility as calcium phosphate. The mineral phosphates are not equally available, because most of them are hydrated basic phosphates. The calcination of the minerals dehydrates the bases and destroys their crystalline structure which removes all objections to the use of mineral phosphates. The pure or mineral phosphates of aluminium, whether calcined or not, exert their maximum effect on calcareous soils.

The effect of iron phosphates is not altered by the addition of lime, at any rate under the conditions obtaining during the experiment. On the other hand, the effect of tricalcic sulphate is much decreased by the presence of lime.

In an alkaline solution aluminium phosphate is dissolved in the soil and readily assimilated by plants.

The contact of the roots with the mineral phosphates is a very important factor for the assimilation of phosphorus anhydride. A. de B.

**1275—The Effect of Mineral Phosphate upon Phosphoric Acid Absorption and the Productivity of Maize and Sorghum.** — FRAPS, G. S., in *Texas Agricultural Experiment Station, Division of Chemistry, Bulletin No. 289*, pp. 1-17. College Station, Brazos County, Texas, February 1922.

This paper gives the results of experiments carried out at the Texas Experiment Station with a view to determining the effect of mineral phosphate upon phosphoric acid absorption and the productivity of maize and sorghum.

To a series of 5 kg. samples of soil poor in available phosphoric acid were added 1 gm. ammonium nitrate and 1 gm. of potassium sulphate. In some cases, increasing amounts of the phosphates used in the experiment were introduced. In this soil maize and sorghum were grown and subsequently their ash was analysed. The conclusions were based more upon the amounts of phosphoric acid abstracted from the soil by the crops than upon the weight of the crop.

The effect of mineral phosphate was about 75 % of that exerted by dicalcic phosphate. The pots given no phosphate produced about 40 % of the yield obtained with a complete fertiliser.

Reckoning the amount of phosphoric acid absorbed by a maize crop by parts per million of soil, 5.53 parts are obtained by the addition of phosphate and 9.43 by the application of mineral phosphate at the rate of about  $2\frac{1}{4}$  tons per hectare (corresponding to 330 parts per million of phosphoric acid) or an increase of 3.4 parts per million of phosphoric acid, equivalent to 847 kg. of maize per hectare.

By increasing the amount of phosphoric acid (from mineral phosphate) from 300 to 600 parts per million the average quantity of phosphoric acid absorbed by a crop is only increased by 0.63 part per million.

When 0 — 300 — 600 — 1200 parts per million of phosphoric acid were respectively added to the soil (which would correspond to 0 —  $2\frac{1}{4}$  —  $4\frac{1}{2}$  — 9 tons of mineral phosphate per hectare), the amounts of phosphoric acid absorbed by the crops were respectively 5.86 — 10.14 — 10.69 — 11.84 parts per million and 0 — 1.43 — 0.80 — 0.50 parts per hundred parts of phosphoric acid added.

These data show that :

a) The addition of phosphoric acid in quantities exceeding 24 tons of mineral phosphate per hectare has little effect upon the amount of phosphoric acid absorbed by the crop and hence on the crop itself, in accordance with the law of decreasing yields ; and the crops diminish very rapidly.

b) The addition of 2 tons of mineral phosphate per hectare increases the maize yield about 847 kg. per hectare, and since only 1.4 % of phosphoric acid is absorbed by each crop, this rise should last for some years.



Mineral phosphate is thus a fertiliser with very weak but prolonged action ; the improvement it produces annually is relatively slight, but its good effects are repeated for several years in succession.

The experimental comparison of different phosphates proved that the soft Florida phosphate is a little more effective than hard Tennessee phosphate. The percentage of phosphoric acid absorbed by the crop was 1.98 in the case of the Florida phosphate and 1.52 in that of the Tennessee ; dicalcic phosphate however proved much more available than either.

Under the conditions of soil analysis, the phosphoric acid of mineral phosphate is almost wholly soluble in nitric acid N/5, but the phosphoric acid added to a soil by mineral phosphate is not as available as that already present in the ground.

A. de B.

1276 — On the Alkalinity of Basic Slag. — DEMOLON, A., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. VIII, No. 24, pp. 680-683. Paris, July 1922.

Basic slag brings to the soil a considerable quantity of lime.

It gives remarkable results in all soils which show a tendency to acidity, and its action is shown especially by a modification of the flora in favour of legumes. The writer has studied a certain number of slags from the point of view of the value of their lime content as assisting in soil reaction.

*Percentage of lime in basic slag rendered soluble  
by the different liquids employed.*

Sample No.	Distilled water	Sweetened water at 5 %		2 % Phenol	Neutral Solution of humate of ammonia	5 % Chloride of ammonia cold	Carbon dioxide in saturated solution	Total lime (soluble in mineral acids)	Oxide of magnesium
	Slag 1 gm. Water: 200 cc. — stirred 1 hour	Raw Slag	After de-carbonisation	Slag 1 gm. Reaction 100 cc. — 1 hour	Slag 1 gm. Reaction 100 cc. containing 0.3 gm. of humates	Slag 1 gm. Reaction: 100 cc. — 1 hour	100 cc. 1 hour		
N° 1	0.67 %	1.17 %	3.20 %	3.24 %	3.32 %	8.73 %	10.69 %	47.05 %	4.48 %
N° 2	1.51	2.35	4.20	4.59	4.46	9.18	9.63	47.10	3.17
N° 3	0.16	0.22	0.92	0.45	1.25	3.92	8.51	44.50	4.29
N° 4	3.75	4.42	5.60	6.49	7.02	10.97	11.92	48.40	2.70
N° 5	2.24	3.24	6.20	5.88	5.63	9.29	10.52	47.26	3.92
N° 6	4.08	5.07	5.73	6.04	5.25	13.10	12.32	46.81	8.12
N° 7	3.08	4.17	4.78	7.56	5.52	10.41	11.64	43.70	7.74
N° 8	1.12	1.45	2.19	2.46	2.83	11.53	7.67	44.25	4.38
N° 9	2.12	2.35	3.36	8.28	5.76	12.88	9.29	41.15	9.05
N° 10	3.36	5.16	6.94	8.62	6.96	11.87	7.39	47.72	3.73

The samples chosen represent the most varied types of basic slag used in agriculture. The determinations made were as follows :

- 1) Lime (CaO) soluble in distilled water.
- 2) Lime soluble in water containing 5 % sugar.

- 3) Lime soluble in sweetened water after decarbonisation by heating.
- 4) Lime soluble in 2 % phenol (LINDET process).
- 5) Lime removed by a neutral solution of humate of ammonia (titrated in the form of calcium oxide after calcination).
- 6) Lime soluble in chloride of ammonia, cold, at various concentrations (titration of ammonia set free).
- 7) Lime removed by a saturated solution of carbodioxide (titrated alkalimetrically);
- 8) Total lime soluble in mineral acids.

There are 2 phases in the reactions obtained : during the first a certain quantity of lime passes into solution in a comparatively short time ; in the second, a slow and continuous solution for 5 days is observed.

The figures given are therefore conventional , but they represent to a considerable degree the lime which is easily dissolved in the first phase.

From these results the following general conclusions may be drawn :

1) Lime, properly so-called, only exists in small quantities (1-3 % on an average) in the basic slag ; it also diminishes by formation of the carbonate when exposed to the air.

2) Complex silicates capable of setting free lime rather slowly under the action of pure water, more easily under that of sweetened water, of a solution of humate of ammonia or of phenol, exist in basic slag. When ammonium chloride or carbon dioxide in saturated solution is present, the lime is dissolved in two phases : in the first,  $\frac{1}{3}$  of the lime dissolves rapidly, the phenomenon then continuing much more slowly. The quick-lime set free only represents therefore a small part of the lime in the basic slag which helps to make the soil alkaline. Further, it is clear that the basic slag in this respect may have on the one hand, an almost immediate effect, and on the other, the action may last a certain time.

The constant presence of magnesia, coming from refractory substances present in basic slag, should also be noted. The quantities varied from 3 to 15 %, with an average of 8.9 % for 25 samples. A considerable part dissolves in 2 % citric acid.

It is not without interest, from the agricultural point of view, to point out that basic slag may supply the soil, in an easily assimilable form, with the manganese which may be lacking. It generally contains 4-5 % of total manganese, easily soluble in 2 % citric acid and partially so in all the weak agents above mentioned. An application of 500 kg. of basic slag per ha. therefore represents an average supply of 25 kg. of the metal manganese.

A. de B.

1277 - **The Potassic Deposits of Catalonia, Spain.** — PESSA G., in *L'Industrie chimique* Vol. IX, No. 104, pp. 387-389. Paris, September 1922

The first news of the discovery of potassic deposits in Catalonia in 1913 caused a great sensation in Spain and other countries, and a keen competition immediately between Companies and individuals at home and abroad to acquire possession of thousands of hectares of land in the mining district.

The first investigations of R. ETIENNE, Professor at the School of Mines in Paris, shewed that the deposits of the Catalonia basin can bear comparison with those of the best German mines and are superior in so far that they lie much nearer to the surface of the soil. On October 1, 1914 when 101 215 hectares of the land had already been sold, the Spanish Government reserved for itself the ownership of all that remained of the basin. A law drawn up on the following bases came into force in June 1918.

- 1) The obligation of owners to prospect and exploit their mines ;
- 2) The privileges given to prospectors (the mining dues to be paid are the lowest fixed by the law) ,
- 3) State control and intervention on the following points ;
  - a) manufacture, production and sale of potassic fertilisers . fixing the maximum and minimum quantities to be extracted annually ;
  - b) maximum sale price on the Spanish market ;
  - c) maximum amount to be exported and minimum prices to be asked on foreign markets.

By this frankly protectionist law the Spanish Government was only following the example of the Government of Sweden, which had similarly controlled the exploitation of its iron, of Germany as regards potash and of the United States as regards phosphates.

After the passing of this law, the exploitation of the mines was carried on with increased activity, especially by the State and the Solway Company which made 13 borings in the Suria district, and sunk a well 9 m. in diameter and 231 m. deep.

The potassic deposits rest on the lower oligocene of the Provinces of Barcelona and Lérida in the Communes of Berga, Vich, Igualada, Balaguer and Isona ; the richest district is towards the east, and has been reserved by the Government. The beds which are between 300 and 500 m. thick are probably derived from a large oligocene lake which, as it dried up, deposited the salts.

The first salt deposited was anhydrite which indicates a very high temperature and great concentration of sodium chloride.

Next came a thick mass of pure, well crystallised sodium chloride upon which was imposed a layer of sylvine and one of carnallite mixed with sodium chloride. The whole set of deposits is protected by a series of marls, sands, and fine limestones in the following order : marls and sands 20 to 80 m. thick — alternate layers of marls and common salt — a layer of potash 60 to 80 m. thick of which 30-35 metres are composed of potassic salts containing 10 % of potassium ( $K_2O$ ) — a 10-12 m. layer of which 2-8 m. are sylvine — a bed of white sodium chloride about 200 m. thick — and finally 2-10 m. of anhydrite and marine limestone.

MARIN, a mining engineer, has estimated the amount of potassium ( $K_2O$ ) only in the Lucia district (10 km<sup>3</sup>) at 10 million m<sup>3</sup> ; the pre-war value of this deposit was 3790 million *pesetas*. MARIN's estimate is however regarded as too low.

The total reserved area measures 440 000 hectares, of which 100 000 belong to private individuals and the remainder to the Government.

The extent of the whole workable area is now reckoned at 60 km<sup>2</sup>, and the beds are considered to be richer in potassium than the German and Alsatian deposits. The carnallite is almost pure, and has yielded 20.60 % potassium chloride and 34.19 % magnesium chloride. The sylvine contains 67.20 % potassium chloride and 28 % sodium chloride.

The potassic salts industry is still in the rudimentary stage. Its development is at present checked by two classes of difficulties. The first is of a secondary and transitory character and depends upon the following facts: 1) the depreciation of the German currency; Stassfurt salts costing 200 marks a ton to make, are only worth 5 *pesetas* on account of the low exchange, whereas Catalonia salts cost 20 *pesetas* — 2) the Hamburg-Barcelona freight rate is 10 *pesetas* per ton, whereas the Barcelona-Valencia rate is 20 *pesetas* — 3) the Spanish miner is unaccustomed to his work and his output is therefore low; he is however paid 5 or 7 *pesetas*, whereas the 70 marks earned by a German miner are only worth 2 *pesetas*..

Among difficulties of a more permanent nature must be mentioned the want of strong Companies backed by a considerable amount of capital, not only to work the deposits, but also to build a large aqueduct to carry the waste magnesian water to the sea, for there are no large rivers in Spain like those in Germany, and 500 litres of water per ton are needed to free the carnallite from magnesium chloride which is most injurious to plant life.

In 1913 Spain used 38 kg. of potassic salts per km<sup>2</sup> or 100 000 tons, whereas in Germany 1350 kg. were applied per km<sup>2</sup>. The agricultural consumption of potassic salts in Spain could be brought up to 100 000 tons, which would mean the extraction of 1 million tons of the mineral. In order that these salts may be sold at a low price in the country, 3 to 4 million tons must be exported annually. Although the deposits are rich enough to furnish such an amount, it will need many years and much more intensive work before this figure can be reached.

The Spanish Government has authorised the export of potassic salts as soon as the home requirements, amounting to 10 000 tons, have been assured.

A. de B.

**1278 - Progress of Nitrogen Fixation after the War.** — HARKER, Y A., in *Chemical Industry*, Vol. XLI, No. 18, pp. 387-390 London, September 30, 1921.

The arc process has been greatly improved by the substitution of air containing 50 % oxygen for normal air; the product is no longer absorbed in the towers, but is extracted in liquid form.

The synthetic ammonia process is the method that has most developed. The first system, which is the one used in Germany, was invented by HARKER but this has been followed by many others as can be seen by reference to the appended table

The cyanamide process, which is often regarded as a little out of date, produced more nitrogen than any of the others. Many factories opened during the war are now shut down as they are too costly to use for the production of fertilisers; amongst them is the American Alabama

*Different processes for the manufacture of synthetic ammonia.*

Country and date	Process	Pressure used in atmospheres	Production in kg. per litre and per hour	Approximate ammonia percentage	Method of ammonia extraction	Source of the hydrogen	Observations
Germany (1913)	Haber-Bosch (Bayerische and Co.)	200	0.3-0.5	7-8 %	a) cooling. b) solution in Catalytic process. water. Solution with 1dem. temperature cycle.	Water gas	Very large unit, speed of gas low, circulation. Preliminary cooling. Operation on large scale. Much higher gas speed. Electric heating. Only as an experiment.
England (1917)	Munitions Ministry (Greenwood and Co.)	150	5-20	2-4	—	—	Experimental plant producing 2 tons a day.
(1921)	Synthetic Ammonia and Nitrates Ltd, Brunner Mond and Co., Billingham.	—	—	—	—	—	—
Unit. States (1918)	General Chemical Co. (Sheffield, Alabama).	less than 100	about 0.4	8	Cooling to 30° or 40° C.	Catalytic process with water gas.	Government Establishments can turn out 11 000 tons of nitrogen annually. Not working at present.
(1920)	Aten. Nit. Corp. Solway Process Co., Syracuse.	—	—	—	—	—	Circulation. Daily output 10 tons of ammonia.
France (1920)	Claude. . . . .	900-1000	about 5	25	Condensation by pressure and temperature.	Various	Without circulation. Daily output 5 tons. 3 plants in series.
Italy (1922)	Casale (Soc. Idros, Terni).	about 500	—	—	Solution . . .	Electrolytic.	Daily output 4 tons.
(1922)	Pfanner . . . . .	—	—	—	Solution . . .	Electrolytic.	—
Norway (1921)	Cedersberg . . . . .	—	—	—	—	—	—

factory which is the largest in the world having an annual output of 200 000 tons.

More or less success has been obtained by various processes for transforming calcium cyanamide into a better fertiliser such as mono-ammoniac phosphate (Ammophos), urea, phosphazote (with 11-12 % of nitrogen in the form of urea and 11-12 % phosphorus anhydride). A process based upon the transformation of cyanamide into cyanide is now gaining ground in America. The annual output of Germany, at the end of this year will amount to 500 000 tons.

A. de B.

**1279 - Advantages of Bicarbonate of Ammonia as a Fertiliser, both from the Point of View of its Production and of its Use.** — GLUND, W., in I *Chemiker-Zeitung*, Vol. XLXVI, No 92, pp 693-697 Cöthen, August 3, 1922 — II *Ibidem*, No 95, pp 715-717, August 10, 1922

I. — Bicarbonate of ammonia, which contains 17 % of nitrogen and consequently 21 % of ammonia, has not yet been largely used in agriculture, though it has been frequently suggested. There are various prejudices against its more extended use, among which is an exaggerated fear as to its volatility. These prejudices should disappear in the face of actual farming practice, and also because, owing to conditions in Germany, there is a restriction on the consumption of sulphuric acid. Several German agricultural stations had very favourable results from experiments made in 1921.

The chief advantages of bicarbonate of ammonia are the following. It does not necessitate, like sulphate of ammonia, the saturation of the soil with useless or injurious matter. In sulphate of ammonia 300 kg. of sulphuric acid per 100 kg. of ammonia are required, 75 % therefore is not utilised. In 1909, 322 000 tons of sulphate of ammonia were applied to the soil, representing 239 000 tons of sulphuric acid, which, under present conditions, would be very expensive. Further, and this is still more serious, sulphuric acid transforms the lime of the soil into gypsum and acidifies it: potash and phosphate fertilisers lose their efficacy if this disadvantage is not avoided by liming, free sulphuric acid often is found, which damages roots, etc. Chloride of ammonia, which is more economical than the sulphate and is therefore coming more and more into use, also possesses disadvantages: the chlorine combines with the calcium of the soil and forms soluble chloride of calcium, which is carried away by the rain, and the soil "cools".

Besides these negative advantages all the components of bicarbonate are useful. Carbonic acid is one of the most important fertilisers and its action is exercised on the roots as well as the leaves. Further, carbonic anhydride costs next to nothing and may be had in unlimited quantities.

Bicarbonate, owing to its fine but not powdery consistency, may be easily spread over the soil, and even after a long period does not become clotted, on the other hand, carbonate has given bad results, for it forms into hard lumps, and the fact that farmers have often mistaken it for bicarbonate has been prejudicial to the latter.

There remains the great objection of volatility, but it has been much exaggerated. It has been proved that up to 50° and under unfavourable conditions, bicarbonate of ammonia loses almost exclusively carbonic anhydride, and only 0.12 % of ammonia on changing into sesquicarbonate. It may be used as a fertiliser mixed with superphosphate, in which case it is fixed by the acidity of the superphosphate. It may be kept for about a year in the ordinary packing without appreciable loss, provided the atmosphere is dry. More impermeable packing may be used than the ordinary boxes and canvas bags. Excellent results have been obtained with paper bags prepared with a special resinous solution. Altogether it may be estimated that from the time of its storage in the factory until it is applied to the soil, less than 5 % is lost. Moreover sulphate is also volatile to a certain extent.

From the industrial point of view it is advantageous in all respects. Ammonia is obtained by direct synthesis by means of the HABER process. carbonic anhydride is a by-product of gas-works and the HABER process. The disadvantages attendant on the use of sulphate in farming have already led to an examination of the question of producing urea on a large scale, it is a neutral fertiliser, but the process of manufacture is complicated, also, the starting point in the process is bicarbonate of ammonia which, in consequence, will always be the more economical.

II — The writer afterwards examines the various industrial manufacturing processes of bicarbonate of ammonia, shows their simplicity as compared with those of other nitrogenous fertilisers and draws attention to their economic advantages. Supposing a factory has a daily output of 2000 kg. of ammonia, the latter would cost, according to its various combinations :

Sulphate of ammonia	.	11 890-19 790	mks
Nitrate	»	19 783	»
Chloride	»	17 313	»
Bicarbonate	»	8 492	»

Further, in contrast to the other manufacturing processes, that of bicarbonate would be independent of several variable factors, such as the price of sulphuric acid, that of nitric acid, etc. The manufacture of bicarbonate, however, cannot be developed in Germany yet as it should be, on account of limitations imposed by the War.

A. de B.

1280 — **Chloride of Ammonium as Manure.** — MAUME L., in *Le Progrès agricole et viticole*, Vol. 39, No 25, pp. 588-592. Montpellier, June 18, 1922.

The writer gives an account of experiments made at the National School of Agriculture at Montpellier on two series of plots : in the first series the manuring was done 10 days before sowing and in the second series on the same day as the sowing. The plots were treated with various nitrogenous manures to the extent of 60 kg. of nitrogen per ha., and then sown with wheat. Taking the yield of the control plot, which was not

manured, as equal to 100, the results with the various manures were as given in the following Table : —

*Results of the manuring experiments.*

Plots	In the first series		In the second series	
	Total weight of the crop	Weight of the grain	Total weight of the crop	Weight of the grain
1. Control . . . . .	100	100	100	100
2. Cyanamide of calcium . .	120	148	102	108
3. Nitrate of soda . . . . .	143	178	136	170
4. Nitrate of lime . . . . .	134	152	115	145
5. Nitrate of ammonia . . . .	131	153	116	148
6. Sulphate of ammonia . . . .	128	152	117	148
7. Chloride of ammonium . . .	134	154	123	150

Chloride of ammonium is therefore comparable with sulphate of ammonia, nitrate of ammonia and nitrate of lime and it could be used to great advantage as soon as it can be obtained at a more reasonable price.

The data in the Table above show that generally there is great advantage in manuring before sowing, especially in the case of cyanamide of calcium, which had only a negligible effect in the second series, while it proved very effective in the first. A. de B.

**1281 — Arsenic and its Uses in Agriculture.** — ROBERTSON, F. J. (Vice-President U. S. Resining and Mining Company), in *Engineering and Mining Journal-Press*, Vol. CXIII, No. 20, pp. 368-369 New York, May 1922

Arsenic is generally found, like sulphur, associated with metals; 130 minerals, or 12 % of the known minerals, contain it. The principal producing countries are Germany, France, Portugal, Spain, England, Turkey, Mexico, Canada, Japan and the United States.

In the United States white arsenic (arsenious anhydride) is collected as a by-product in the foundries of the West. Sulphurous and arsenical gases are precipitated and refined in special furnaces and give a product containing 99 % or more of arsenious anhydride. White arsenic is chiefly used in the manufacture of insecticides, for destroying weeds and for disinfecting large and small animals. Some horticulturists and arboriculturists use arseniate of lead for spraying the ground.

Weeds, especially along the railway lines are destroyed by means of large applications of arsenic. In 1920 in the United States 15 000 tons were used; in 1921, not more than 9000 tons. Before the war most of it was exported; from 1901 to 1910 the United States produced large quantities and exported 4240 tons. The annual consumption rose from 3400 tons in 1904, to 15 000 tons in 1920.

Arseniate of calcium has proved very effective against the cotton boll weevil and as the latter has invaded all parts of the United States where cotton is grown the demand for arseniate will greatly increase.



If properly prepared, the arseniate does not injure the plants like Paris green, as it is less caustic; 3 to 5 applications of arseniate, at intervals of 4 or 5 days, to the extent of 5 to 7 kg. per ha., suffice. Owing to the cost of arseniate it cannot be profitably used on land which, under good conditions, does not produce at least 5.5 kg. of cotton per ha. If the use of arseniate became general in cotton plantations it would absorb the whole American production of arsenic, allowing for a consumption of 15 to 28 kg. per hectare. At the present moment the chief difficulty is to find an effective method for its application. The present consumption of arsenic is estimated as follows. —

In the glass industry . . . . .	2500 to 3000 tons
For disinfecting cattle, about . . . . .	1500 "
In the manufacture of paints and other uses, about . . . . .	500 "
In the preparation of insecticides and fungicides . . . . .	5000 to 9000 "

White arsenic is sold in barrels of 2 qx or in packets of from 0.5 kg to 5 kg. Many States buy arsenic wholesale and let the farmers profit by the lower price. The production of arsenic has now reached such a point that, unless the demand for the manufacture of insecticide increases greatly, there will be a surplus production for export. The agricultural consumption of arsenic increases every year, its efficiency as an insecticide being more and more appreciated. A. D. B.

1282 — **Selection and Treatment of Waters for Spraying Purposes.** — DEONG, R. C. in *University of California Publications College of Agriculture, Agricultural Experiment Station, Berkeley, California*, Bulletin No. 378, pp. 301-311, figs. 2. Berkeley, California, December 1921.

Hard water forms dangerous combinations with or destroys the efficiency of many forms of insecticides. Such waters are very common, especially in the west of the United States. Their distribution and degree of hardness is however a matter of which the knowledge is approximate only.

Softening hard waters by means of caustic soda or other water softeners is not completely successful in all cases, and hauling soft water from a distance in quantities sufficient for spraying purposes is frequently impracticable. Surface waters are usually softer than underground supplies, but storage of surface water during rainy seasons is possible only in limited areas.

Water softening plants may be installed at a cost of a few hundred dollars with a sufficient capacity for supplying a spraying outfit and also meeting the ordinary needs of the home.

The use of dusting materials in certain cases in place of liquid sprays, offers an advantage in that the user is independent of the type of water.

Insecticides, compatible with the soluble salts commonly found in waters are valuable and may be a satisfactory solution of the difficulty in some cases.

Water containing chlorine at the rate of 20 parts per million or more

has been reported as dangerous to use with acid arsenate of lead, a soluble form of arsenate being formed, which may cause severe injury to foliage. Basic arsenate of lead should be substituted for the acid type, if used with very hard or alkaline waters.

Californian waters have an unusually high chlorine content, which may account for cases of arsenical injury that have occurred where acid arsenate of lead has been used.

A. d. B.

AGRICULTURAL  
BOTANY,  
CHEMISTRY  
AND  
PHYSIOLOGY  
OF PLANTS

- 1283 - On the Presence of Cobalt and Nickel in Plants (1). — BERTRAND G. and MOKRAGNATZ M., in *Comptes rendus de l'Académie des Sciences*, Vol. 175, No. 11, pp. 458-460 Paris, Sept. 11, 1922.

The writers while carrying out their experiments on nickel and cobalt in the soil have succeeded in determining these metals, as well as copper and zinc which accompany them, quantitatively in samples of soil of about fifty grammes weight.

They also analysed the ashes of 20 samples of different species of plants, using for preference the portions which are used for food:— carrot, onion, potato, spinach, lettuce, cress, tomato, apricot, lentils, kidney-beans, buck-wheat, wheat, oats, maize, rice and chanterelle. They analysed 1-2 kg. of the different plants; the cobalt was separated in the form of cobalto-nitrite of potassium and the nickel in combination with dimethylglyoxin.

Positive results were obtained for nickel with all the plants and for cobalt with all except carrots and oats. The cobalt varied from  $\frac{1}{200}$  of a mgm. to 0.3 mgm. (buckwheat) per kilogramme of fresh matter; nickel from 0.01 mgm. (tomato) to 2 mgm. (peas).

It remains to be ascertained whether the presence of these metals in the plant organism is only passive, or whether it supplies a physiological need.

A. de B.

- 1284 - Biochemistry of *Sclerotinia cinerea*. — WILLAMAN, J. J., The Function of Vitamins in the Metabolism of *Sclerotinia cinerea*, in *The Journal of the American Chemical Society*, Vol. 42, No. 3, pp. 945-985, 8 figs. Easton, Pa., March 1920. — II. WILLAMAN, J. J., Pectin Relations of *Sclerotinia cinerea* in *The Botanical Gazette*, Vol. LXV, No. 3, pp. 221-229, bibliography of 10 publications. Chicago, Ill., September 1920. — III. WILLAMAN, J. J., and SANDSTROM, W. M., Biochemistry of Plant Diseases, Effect of *Sclerotinia cinerea* on Plums *Ibidem*, Vol. LXXIII, No. 4, pp. 287-307, 7 figs., bibliography of 54 publications, April 1922. — IV. WILLAMAN, J. J. and DAVISON, F. R., Biochemistry of Plant Diseases, Proximate Analysis of Plums Rotted by *Sclerotinia cinerea* *Ibidem*, Vol. LXXIV, No. 4, pp. 104-109, 2 figs., bibliogr. of 6 publ. Sept. 1922.

I. — The writer determined to make researches on the biochemistry of parasitic fungi. For this purpose he chose *Sclerotinia cinerea* (Bon.) Schröter, for it develops well even in the saprophyte state, which facilitates study in the laboratory, where it may be cultivated under artificial conditions.

In the first series of experiments the writer ascertained the conditions

(1) See R. Nov. 1922, Nos. 1016 and 1033. (Ed.)

of growth. CURRIE had already experimented with this object in view on *Aspergillus niger*. Results showed that this fungus grows luxuriously and fructifies in media containing saccharose, nitrates and salts which furnish potassium ions, magnesium, sulphate and phosphates.

The writer's researches prove that *Sclerotinia* has greater needs: defined chemical elements are not sufficient, even if nitrogen is supplied in the form of amino-acids or asparagine. It absolutely needs *vitamines* or factors accessory to growth.

The writer uses this term because it is consecrated by use in scientific and ordinary literature, though it is not certain that the substances spoken of here are of amine structure. It is a question of substances necessary for the accomplishment of organic functions but which take no direct part in vigorous and material exchanges; evidently there are several kinds: A, B, C.

Indispensable to animals which are incapable of producing them, they are supplied directly or indirectly by plants. It is doubtful whether they are phytogenous, according to the researches of BOTTOMLEY and other writers, plants themselves utilise symbiotic bacteria, *i. e.* those living in the soil, or the supply of these essentials or of similar substances termed *auximones*. APPLEMAN maintains that in potato tubers there are substances of this nature, indispensable to the vigorous growth of the young plants, hence very small seedling potatoes should not be used.

Many inferior forms of life are capable of producing *vitamines*; for instance, the typhus bacilli, according to PACINI and RUSSELL, develop a *vitamine A*, *i. e.* of growth, which would explain the increase in weight and size observed in many young subjects after an attack of typhoid fever. Other inferior forms of life, on the contrary, must exhaust the *vitamines* in their surroundings. This has been proved by WILLIAMS in the case of the bread-making blastomycetes. In the absence of *vitamines* their growth ceases; the *vitamine* content of flour may be estimated by noting the rate of increase of the yeast cells. LLOYD has proved that even meningococci only increase where *vitamines* are present. Similar facts have been observed by DAVIS in the case of the Pfeiffer or influenza bacillus.

The writer then points out that the behaviour of *Sclerotinia* is very similar. This Hyphomycete must have *vitamines*, which should be in the surrounding medium, for instance in fruits. In artificial culture, *Sclerotinia* develops very much better if the substratum contains fruit juice: that of the peach is the most effective. This is shown very clearly by the accompanying graph (fig. 1), where the two lower curves (184 and 186) represent the development of colonies of Hyphomycetes when fruit juice is lacking. The three elevated curves (183, 185 and 187) show the increased development when plum juice is present.

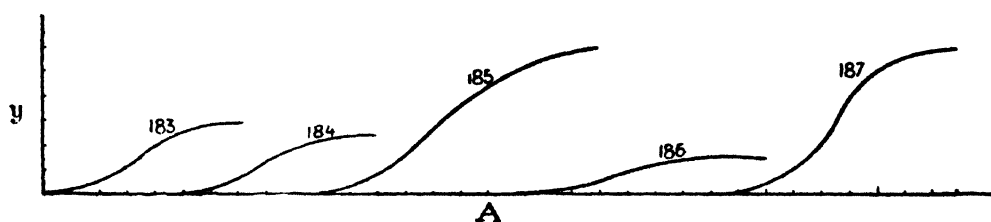
The *vitamines* necessary to the growth of *Sclerotinia* may be extracted from acid liquids by means of fuller's earth, after which they are passed on to alkaline liquids. This isolation process, which was invented by LLOYD for alkaloids, is equally applicable to the *vitamine B*. The pectin

however should be first precipitated with alcohol. In this way the vitamins are freed from many other substances with which they are combined, including some whose action is injurious, like tannin.

By this process the writer has proved that the vitamins necessary to the growth of *Sclerotinia* are contained in many substances: pollen, the terminal buds of legumes, the spores of fungi, hyphomycetes, blastomycetes, milk, pancreatine, etc.; speaking generally, they abound in vegetable tissues endowed with, or capable of, intense metabolism.

The writer raises the question whether the vegetative growth and the reproductive activity of *Sclerotinia* are connected with 2 distinct vitamins. Certain facts favour this hypothesis. For instance, fuller's earth seems to absorb now one, now the other, more rapidly according as the medium is aqueous or alcoholic. High temperatures seem to destroy the principle of vegetative growth more rapidly than that of reproduction.

FIG 1 — Development of colonies of *Sclerotinia* in cultures of 25 cc of nutritive solution



EXPLANATION.

Y = increase in cc, A = age in days

Curve 183: addition of 2 cc of plum juice

" 184: " of 0.1 gm of glycine

" 185: " " " " and 2 cc of plum juice.

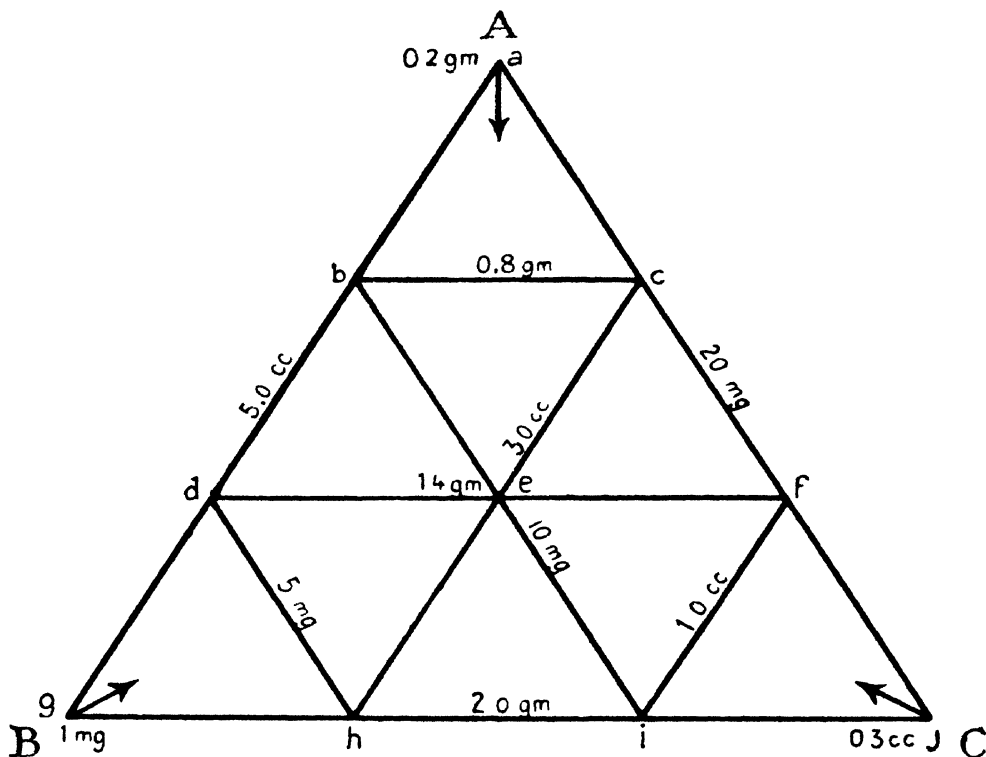
" 186: " of 0.1 gm. of asparagine

" 187: " " " " and 2 cc. of plum juice

Most of the products containing vitamins, enumerated above, seem to favour vegetative growth only, while very few have any influence on the development of reproduction. Certain concentrations favour vegetative growth more than reproduction, as though there were two principles with distinct properties. This latter action is shown clearly by systematically varying the proportions of the principal constituents of the culture according to a system of 3 co-ordinates invented by SCHREINER and SKINNER (See fig. 2). Each series of co-ordinates corresponds to one of the principal components of the nutritive medium, viz., nitrogen (asparagine), sugar, vitamin (fruit juice), each point of intersection represents a culture made in a medium containing the quantities of nutritive materials shown in the co-ordinates relating thereto. Vegetative growth is measured by the writer from the diameter of the colonies (maximum 6 cm.).

Reproduction development is given by the density of the spores (expressed in 5 degrees). The zone of the greatest vegetative growth, bounded by a line within which the fungus produces colonies of more than 5.5 cm.

FIG 2 — Diagram showing the effect of different amounts of sugar, nitrogen (asparagine) and vitamins (fruit juices), on the vegetative growth and spores of *Sclerotinia*



#### EXPLANATION

A = sugar ; B = nitrogen , C = vitamins

in diameter, does not coincide with the zone of the greatest spore development, marked by a line corresponding to the 3.5 degree. The vitamins which stimulates reproductive activity therefore seems to act differently from that which stimulates vegetative growth. The varying action of these principles is not modified by varying the proportions of the other constituents. If the vitamins which cause increase in reproduction are in excess, they limit the action of those which favour vegetative growth. This is perhaps because they draw nutritive substances from vegetation by the growth organisms and divert them to the formation of spores.

The writer does not consider that these tests show with certainty the two actions of the vitamins indispensable to the growth and reproduction of *Sclerotinia*. He even believes it possible that only one vitamin comes into action, viz., thermolabile, dialysable through collodion, precipitated by phospho-tungstic acid, widely disseminated throughout nature and which might be identified with the "B" or antineurotic vitamin. In small quantities it only favours vegetative growth. Otherwise, in the earlier periods, it causes an increase of reserves and then favours reproduction. These two actions, therefore, must be two manifestations of one and the same activity. They appear to be connected with the respiratory exchanges. The apparent complications described may be attributed to the coexistence of other substances; for instance, fuller's earth removes toxic substances also which are only active in a highly concentrated form: the latter therefore may be less favourable than weak concentrations to the growth of *Sclerotinia*. The new question raised by the writer as to both actions, or that of growth vitamins alone, must be studied later.

II. — The writer has studied the chemical phenomena which take place when fruit is attacked by *Sclerotinia*.

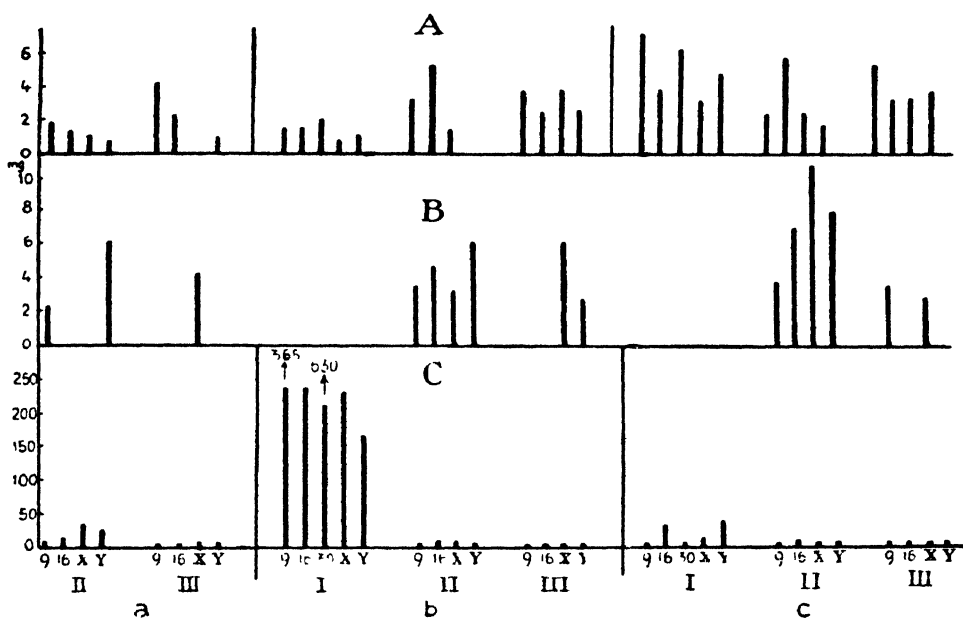
He refers to the previous work of COOLEY, VALLEAU and HAWKINS, nearly all carried out by inoculating healthy fruit with the hyphomycete. The writer, on the contrary, has worked on fruit extracts. He has thus seen that in the absence of sugars or after having utilised all the available sugars, *Sclerotinia* lives at the expense of the pectin, i. e. of the substance which cements the cells. This action takes place at several periods. Above all, the pectin is rendered soluble by an enzyme, through which the hyphae can insinuate themselves between the cells when the fungus invades a tissue. Afterwards the soluble pectin is coagulated by another enzyme (pectase), which forms pectate of lime, soluble in alkalis and dilute acids and reprecipitated by alcohol. This gel absorbs water, so that the fruits retain their consistency and the injury is less apparent, a characteristic trait of attacks by *Sclerotinia*. Finally, both the soluble pectin and the pectate of lime are hydrolysed, probably under the influence of a third enzyme, *pectinase*. This hydrolysis is accompanied by the assimilation of the constituent of the pectin which contains furfural, of which  $\frac{9}{10}$  disappear but which is not stored in the hyphae, and microchemical tests do not reveal its presence. Reducing sugars are given off. The action of the fungus seems to be favoured by the production of oxalic acid.

III. — The writer has experimented to find out the differences between the varieties of fruits which resist *Sclerotinia* and those which do not as well as the changes produced by the parasite. He has used 5 varieties of plums, of which 3 are resistant (Burbank  $\times$  Wolf 9, Burbank  $\times$  Wolf 16 and Abundance  $\times$  Wolf 30, which are represented in the diagrams by B  $\times$  W 9, B  $\times$  W 16 and A  $\times$  W 30, or more simply by 9 — 16 — 30) and 2 sensitive (Compass and Sand Cherry, or C and S C F). He examined them in the following stages: 1) half-growth; 2) full-growth, at the commencement of the ripening period; 3) when ripe (in the diagrams: I, II, III). He divided them into 3 parts: one was examined immediately, the second

after being attacked by the fungus and the last was kept and examined as a check at the same time as the second (in the diagrams: *a*, *b* and *c*).

Those resisting attack all had a thicker skin ; but the writer overcame this difficulty by inoculating the spores in suspension in the interior of the fruit by means of a hypodermic syringe to find out if there was no other kind of physiological difference.

FIG. 3 — Oxalic acid and tannin content of some species of plums



EXPLANATION :

- A = oxalic acid of the juice ;
- B = oxalic acid of the residue ;
- C = tannin of the juice.
- I, II, III = periods of growth
- a = fresh fruit ; b = preserved fruit ; c = mildewed fruit

The most resistant varieties are more consistent, contain a more compact pulp and rarely have a higher specific gravity. They are attacked more slowly and show fewer conidiospores.

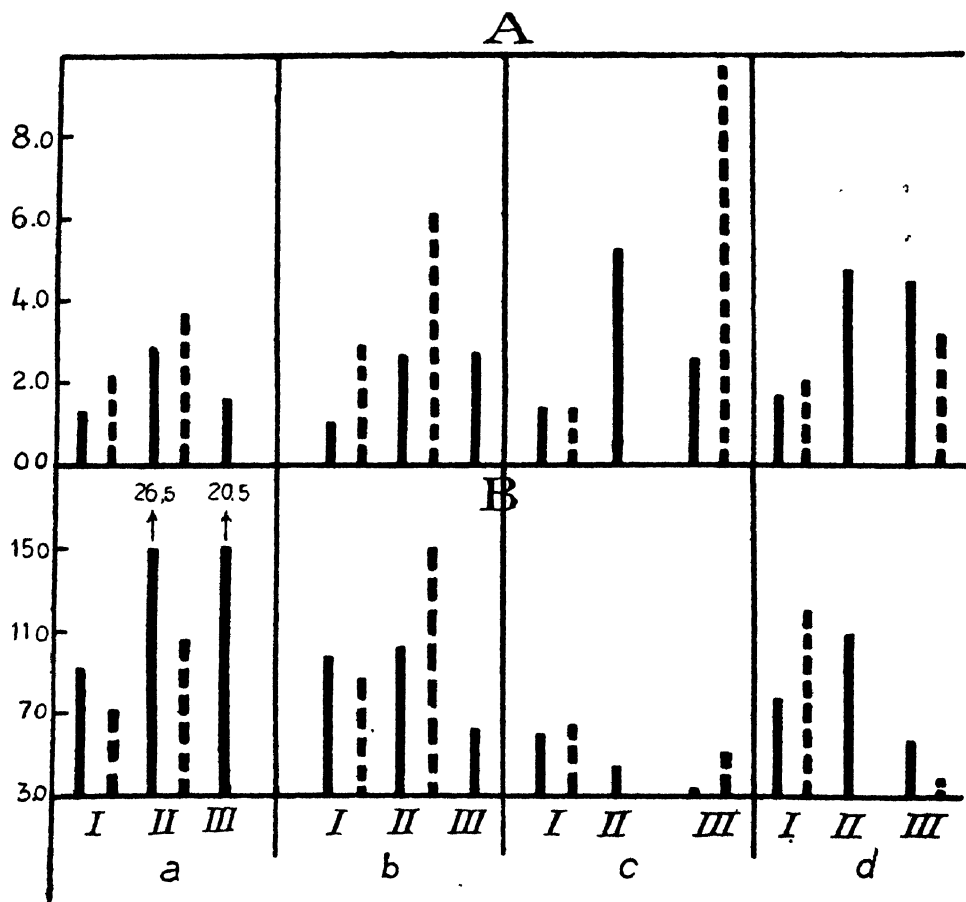
The previous work of other writers had resulted in excluding the action of tannin or acidity in determining the resistance to *Sclerotinia*.

The chemical tests made by the writer show some differences which are not sufficiently marked to explain the differences of receptivity. For instance, the most resistant plums are rather richer in hydrogen ions and

oxalic acid ; but the total acidity is less. Fig. 3 shows the action of oxalic acid and tannin.

The attack by the parasite naturally greatly modifies the composition of the fruits. As shown in fig. 3, in plums gathered from the tree and preserved, there is normally an accumulation of tannin ; the red-brown rot on the contrary, prevents this ; at the same time, it gives rise to oxalic

FIG. 4. — *Composition of 4 varieties of healthy and rotten plums at 3 different periods of growth.*



EXPLANATION :

A = ether extract ; B = cellulose.

I, II, III = periods of growth

Continuous lines = healthy samples ; dotted lines = rotten samples.

Varieties : a and b resistant ; c and d non-resistant.



acid. Further, the acidity (true or titratable) decreases. There is a notable increase of protein nitrogen. This is evidently due to the fungus converting into proteins part of the more simple nitrogenous compounds of the fruits and accumulating them in its mycelium.

IV. — Later researches concerning modifications produced by *Sclerotinia* on plums show that the fungus increases the proportion of ash, lime, nitrogen and ether extract; but this action is of little importance, for it is due to the more active evaporation by atmospheric hyphae. The differences between susceptible and resistant varieties was but little marked: the latter proved richer in cellulose and less rich in ash, nitrogen, lime and ether extract (See fig. 4).

As the fruits ripen, organic acids and carbohydrates accumulate, so that there is a corresponding decrease of ash, nitrogen and lime. L. V.

1285 — **Ammonia as a basal and a final Product in the Transformation of Nitrogen by Plants.** PRIANISCHNIKOW (Agricultural Academy of Moscow), in *Die Landwirtschaftlichen Versuchs-Stationen*, Vol. XCIX, Parts 1 and 3, pp. 267-286 Berlin, 1922

The author suggests that the formation of asparagin in plants is a secondary product of the process of hydrolysis which breaks up the protein molecule, thereby giving rise to amido acids, and that oxidation leads to the formation of ammonia and asparagin. The truth of this hypothesis, which finds a parallel in the digestion of proteids in the animal organism, was later confirmed by BUTKEWITCH. Ammonia would therefore appear to be the final stage in the decomposition of nitrogenous substances, and together with malic acid and to some extent with aspartic acid, is the point of departure for the formation of asparagin.

By his former work the author has proved that barley-seedlings can convert ammonia almost completely into asparagin; on the other hand, the development of pea-seedlings is hindered by ammonium salts *e. g.*, chloride and sulphate, but if these salts are neutralised by calcium carbonate, pea-seedlings also can transform ammonia into asparagin.

The author describes some of his experiments on *Vicia sativa* and *Zea Mays*; the former behaves like the pea, and the latter like barley. The different behaviour of the two families must not however be deduced from this fact. Yellow lupins give quite unexpected results; in these plants, which are rich in ammonia, no asparagin synthesis ever takes place even in the presence of calcium carbonate; when supplied with ammonium salts, the lupins show a decrease in total nitrogen and also in asparagin. This diminution increases with the amount of ammoniacal nitrogen present, and may perhaps be due to loss caused by drought. In the case of lupins, it appears that ammonia replaces asparagin as a final product. Not only is there no synthesis of ammonia at the expense of the external ammonia, but the amount of asparagin produced by the protein substances of the plant is also diminished. If the sulphate and chloride are replaced by the phosphate and nitrate of ammonium and urea added (which quickly produces ammonia in plants), the asparagin synthesis proceeds without any hindrance.

The cause of the different behaviour of lupins must be attributed to the difference in their chemical composition ; these plants contain the largest amount of protein substances, and whereas in Gramineae, the relation between protein substances and carbohydrates is 1 : 6, it is 1 : 2 in other Leguminosae, and 1 : 0.6 in lupins. Hence it may be concluded that carbohydrates and fats promote the synthesis of asparagin. This has been proved by other experiments in which by diminishing the carbohydrates in barley (deferring the examination of the seedlings from the 10th to the 12 day), the author obtained a result similar to that in the case of lupins. On the other hand, by increasing by other means the carbohydrate content of the lupins, the author made them act just like other plants.

Whereas the animal organism normally converts ammonia into urea which can be evacuated without any loss, plants neutralise ammonia by producing asparagin which accumulates in the plant sap to be again used in the synthesis of albumen.

Light exerts no influence upon asparagin synthesis. A. de B.

PLANT  
BREEDING  
(SELECTION)

1286 - Pedigree Selection of Göttingen Rye (Germany). — SEEDORF, W., in *Journal für Landwirtschaft*, Vol. 70, Parts II-III, pp. 163-190. Berlin, 1922.

Göttingen rye was obtained from Böhmerwald rye. As long ago as 1879, DRECHSLER began his work by choosing out the best ears, but it was not until 1890 that with LIEBSCHER any individual selection properly so-called was attempted. The improvement and selection work has already extended over a period of more than 20 years and has been the object of unremitting attention on the part of Prof. VON SEELHORST, for 25 years Director of the Göttingen Agricultural Institute.

Göttingen rye is very productive ; in good years, when it does not lodge or suffer from cold during the winter, the yield may be 40 hectolitres per hectare. It tillers freely, so that although the weight per 100 grains is considerable (4.5 gm.), the amount of seed corn required per hectare is only 66 kg. On the other hand, the straw is very long, which inclines it to lodging, and the ears are too loose.

In the work analysed, the author gives the results of a series of experiments carried out between 1905 and 1921 with the express object of eliminating the two above-mentioned defects. As material, line 7 was used and the following characters were taken into account : length, thickness and number of internodes, weight, length and density of ear, number of grains set, and percentage of sterile flowers, percentage of grains and weight of 100 grains.

Some improvements have been obtained as regards the thickness of the culms (vigour), the weight, density and setting of the ear. The grain percentage, weight per 100 grains, and length of ear have however not been altered, and all attempts to obtain shorter culms have proved in vain. The selection work, although persevered in for a considerable period of time, has in no wise modified the coefficient of the correlation between the different characters.

As was said above, the objects aimed at were only partially secured.

The cause of this want of success may perhaps be attributed to the existence of a correlation opposed to the aim of the work. In fact, a positive correlation has been observed between the length and thickness of the culms and the length of the culm and the weight of the ear, so that by increasing the latter, which was the object of selection, the length of the straw was also increased, a result quite opposite to what was desired. In both cases, however the correlation coefficient was so low ( $r = 0.2-0.3$ ), as to be unable of itself to offer any serious hindrance to the progress of the work. The number and density of the ears, and the weight per 100 grains are not correlated with culm length and vary independently of it.

A high correlation coefficient (from  $+0.25$  to  $+0.612$ ) is met with between straw length and the number of internodes; in order to obtain short types, it would be necessary to give the preference to forms with few internodes. In any case however a correlation of this sort, although the coefficient is high, cannot be regarded as forming a certain basis for selection.

Ear weight is in positive correlation with culm thickness, length of ear, fertility and weight per 100 grains; as regards culm thickness, it is not only in correlation with the weight of the ear, but also with the density and length of the ear. This correlation should assist the work of selection.

On the whole, it may be said that if on the one hand, the correlations cannot of themselves form a hindrance to the attainment of the aims of selection, on the other hand they do not offer the large amount of choice that is generally available.

The existence of correlations can be used in the preliminary field-work, but in the laboratory the biometric data of each character are surer guides.

The experiments mentioned in this article were confined to the individuals of a single line; all cross-pollination therefore was necessarily excluded, but although there was danger of a progressive increase in the homozygote, it cannot be said that any bad consequences resulted. G. A.

1287 - Trade in Forage in belligerent Countries. — LOPRIORE G., extract from *Le Stazioni Sperimentali agrarie italiane*, Vol LXIX, pp 179-185. Modena, 1922.

SEEDS

These notes form one of the articles published in *Le Stazioni Sperimentali Agrarie italiane* on the "Solution of the Agricultural problems raised by the war".

Trade in seeds depends largely on the knowledge of their origin: this may be determined by the presence of the seeds of weeds growing among the forage plants. But although it is easy to recognise the origin of seeds of pure species, it is somewhat difficult to find out the origin of mixtures with cheaper seeds of bad quality, which are common in trade.

In Italy the seed trade has never been sufficiently considered, because up to the present, no trouble has been taken to do more than ascertain the germinative power and the presence of seed of dodder, whereas elsewhere researches of practical importance have been made regarding the origin and selection of the seeds. It now remains to be seen whether the old

method of determining the origin, based on the presence of seeds of weeds, can be corroborated by the method based on the presence of mineral particles of the soil. For if the methods in which the fraudulent mixing of seed is carried out have succeeded in eliminating the seeds of weeds they will be equally successful in the case of mineral particles.

Among the most important Italian seeds are those of violet clover and lucern. The former is recommended in Germany by WITTMACK, because of its moderate price and its resistance to parasites, while it is discredited by others who prefer to abandon meadows rather than sow plants incapable of standing the rigorous winters of the North.

Excluding certain infesting plants (*Helminthia echinoides*, *Arthrolobium scorpioides*, *Lotus corniculatus*, *Phalaris paradoxa*, *Andropogon halepensis*) sulla has lost, as an associate of violet clover, much of its importance from the experimental standpoint. It gives place to lucern and meadow clover, which are spreading in the Marches and Romagna, whence they are exported in large quantities, while on the other hand, they are spreading in Spain and in the South of France. In reality violet clover, which has been sold, for reasons connected with the war, under various names (Apennine red clover, red clover of the mountains of Upper-Italy) as an essentially southern species, does not exhibit, in relation to slight differences of altitude, such clear variations as those of seeds of the North and South of France. This fact suggests that Italian seeds should not be considered to possess the characters of French seeds from the North or South. For war reasons, seeds from the Argentine, passing through France, were also introduced later under the French name. Italian lucern attracted the attention of the German inspectors because it was suspected that seed from Provence was sold as Italian lucern and the latter in its turn as lucern from Turkestan. These inspectors quickly recognised Turkish origin, owing to the presence of *Acroptilon repens* L., one of the Compositæ very common in the East. Certainly, for the purpose of identification of species seeds of sulla have not the same importance for lucern as for violet clover; they however allowed Italian origin to be recognised.

On the other hand, *Andropogon halepensis* is rarely found in lucern seeds, so that it has not the same importance for their identification as for violet clover. *Silene dichostoma* Ehrh. formerly characteristic of the flora of Russian meadows, has spread into Silesia and Southern Germany; it therefore makes these Provinces *suspect* also, but it is no longer *typical* of Russian seeds.

After all if it is of little importance to know that seed is from Provence or Italian; it is, on the contrary, important to know Asiatic origin, and this is also easily identified. As a matter of fact, out of 10 samples of native lucern, 5 were Italian, 3 from Turkestan and from Southern Europe, that is to say without traces of spontaneous seeds of Italian origin.

Russian and Hungarian seed, which are easily recognised when separate, present difficulties for determining their origin when mixed.

After all, the fact that no dodder seed was found is creditable to Ital-

ian merchants who have thoroughly understood how to remove the dodder from their seeds before export.

Foreign botanists have certainly generalised too much in considering as characteristic of the flora of Italian meadows, plants common to various places of origin introduced into the country owing to trade facilities and their aptitude of adapting themselves to different environments. And in this way the number of ubiquitous species has considerably increased, so that certain indications, which were formerly positive, have gradually become negative, losing much of their diagnostic importance.

The German agricultural press recommends that seeds of forage plants should be grown in Germany so as to avoid the necessity for recourse to imported seeds.

G. L.

1288 - Autumn Cereals in Morocco. — *Annales de l'Institut Colonial de Bordeaux*, pp 108-115 Paris Bordeaux, April 1922

CEREALS  
AND  
PULSE CROPS

In Western Morocco, autumn cereals cover about 1 750 000 ha., out of a total sown area of 2 140 000 ha., or 82 %; of these cereals barley occupies about 900 000 ha., wheat 800 000 ha. and oats 4000 ha. These areas however vary from one year to another.

BARLEY. — Barley is exclusively represented by *Hordeum vulgare* var. *tetrastichum*; in a very few localities a variety with naked grain (*H. nudum*) is found; *H. distichum* or brewer's barley, is non-existent; the local varieties however can be used for making certain beers if the season is favourable, and they are able to find a market in France or in England. Their composition is very homogeneous; the most marked variation is found in the content of nitrogenous matter, which may vary from a minimum of 8.75 % to a maximum of 11.94 %.

Barley is mainly used for feeding cattle, but in times of scarcity it is also used for human food. Methods of sowing and cultivation are imperfect; if they were improved the crops would be very much more abundant. Calcareous-clay soils are suitable for these varieties of barley, but they are grown generally.

On December 1, 1921, the price of barley was 35 fr. per quintal at Casablanca, 40 fr. at Rabat, 30 fr. at Meknès, 25 fr. at Marrakech, 32<sup>fr.</sup> 50 at Magazan, 31 at Safi, 30 fr. at Mogador, 35 fr. at Fez, 34 to 39 fr. at Oudjda.

WHEAT. — The wheat crop is almost as important as the barley crop. The local varieties belong exclusively or almost exclusively to hard wheats; soft wheat was introduced after the French occupation and covers 16 440 ha. only, out of a total area of 733 121 ha. under wheat. There are about fifteen types of wheat in Morocco, often mixed in the crops, with a fairly high content of nitrogenous matter, varying between 12.31 % and 13.87 % and it is very nearly the same as in the best hard races. An improvement in cultural methods, a good choice of seed, and selection would increase the yield considerably. The yield varies round about 7 qx. per ha. and is higher than that obtained in Tunisia. The Arabs distinguish certain varieties

which are being tested to ascertain their agricultural value, notably "Tréa" and "Asker".

Year	Hard wheat		Soft wheat	
	Area	Yield	Area	Yield
1918 . . . . .	774 331 ha	6 090 116 qx	10 574 ha	86 941
1919 . . . . .	842 948	4 384 696	12 743	76 231
1920 . . . . .	775 808	4 770 184	11 041	72 861
1921 . . . . .	766 670	6 118 051	16 412	141 67

Soft wheat was unknown before the French occupation: the yield which was 75 000 qx. in 1920, increased to 178 000 qx. in 1922. The most commonly grown varieties are the "touzelle" of Oran and bearded wheats imported from Algeria.

On December 1, 1921, the price per quintal varied, according to locality, between 50 and 70 fr. for soft wheat, and between 45 and 70 fr. for hard.

OATS. — The cultivation of oats is recent, and does not date further back than the beginning of the Protectorate. The varieties grown are Algerian, especially the yellow and black kinds.

*Areas cultivated under oats (hectares).*

	1915	1916	1917	1918	1919	1920	1921
By Europeans . . . . .	—	—	2458	3460	3609	2959	3335
By Natives . . . . .	—	—	365	793	660	399	231
<i>Totals</i> . . . . .	<b>1609</b>	<b>1752</b>	<b>2823</b>	<b>4253</b>	<b>4269</b>	<b>3358</b>	<b>3566</b>

Oats are used for cattle by Europeans and by the army of occupation.

RYE. — The area of cultivation is fairly limited in a few mountainous regions, though experiments made by the Directorate of Agriculture show that it could be grown anywhere, even on the light, sandy soils of the coast, and a yield of 14-15 qx. of grain per ha. in addition to straw obtained. If sown early it would be possible to cut it green during the winter and to get a fairly good crop of grain in May-June.

CANARY-GRASS (*Phalaris canariensis*). — Cultivation is limited and it is sown at the beginning of winter and harvested in June. The seed is used for feeding birds; an oil, used for dressing cotton cloth, and very commonly used in England, can also be extracted from it.

On December 1, 1921 the price of the seed varied between 50 fr. per quintal at Fez and 125 fr. at Rabat.

F. C

1289 - **On the Tillering of Wheat.** — GARICKF, W. F (Laboratory of Soil Chemistry and Bacteriology, University of California), in *American Journal of Botany*, Vol. IX, No. 7, pp. 366-369. Brooklyn, July 1922.

The writer had previously remarked that nitrogen, supplied to wheat at different times, had different effects; at an early stage it had little effect; at a later stage it caused an increase in the nitrogenous reserves of the grain and the whole of the dry matter in the plant. These experiments were made with a soil poor in nitrogen.

In the paper reviewed, the writer investigated the process by the help of which nitrogen induces tillering. He supposed that it acted by favouring the growth of the roots. In order to verify that supposition, he grew wheat plants, from 8 to 10 cm. high, with roots 10 to 12 cm. long, for 25 days in drinking water: the roots grew to a length of from 50 to 70 cm., while the stems scarcely grew more than 1 or 2 cm.; he then moved the plants, together with the control plants, and placed them in complete nutritive solutions; the weight of the aerial part was approximately equal in the two series, while the weight of the roots was respectively about  $\frac{1}{2}$  and  $\frac{1}{4}$  of the total weight and the roots in the first series were 4 times as long. The control plants tillered very slightly, generally a single stem per plant; on the other hand the young plants with large root development tillered in a remarkable manner; the averages were, respectively, 1.2 and 5.4 per plant, a proportion of 1: 4.5.

A large root development, therefore, is very favourable to tillering. In a soil poor in nitrogen, the roots develop very much because they seek out nutritive elements; if a large amount of nitrogen is put into the soil, the roots absorb it and vegetative growth is stimulated in them: there is consequently much tillering; on the other hand if nitrogen is given during the early stage of growth, the roots do not develop much and the growth cannot be stimulated later.

These data may be important for the cultural economy of wheat.  
L. V.

1290 - **Cultivation of Barley in England.** — RUSSELL E. J., in *Journal of the Institute of Brewing*, Vol. XXVIII, No. 9, pp. 697-713. London, September 1922.

1290.

The cultivation of barley is very ancient and goes back to the Neolithic period; it is also one of the most general crops in the world, as it extends from the Arctic Circle to the Equator.

The decrease which the cultivation of barley in England has suffered is less than that of wheat and England is nearer freedom from importing barley than wheat as may be seen from Table I, in which the figures indicate millions of tons.

England has about 800 000 ha. under wheat and 600 000 under barley; Scotland and Ireland each have 24 000 ha. under wheat and 80 000 under barley.

Wheat and barley grow better in dry climates. In England the distribution of barley and wheat crops is approximately inverse to the rain-

TABLE I. — *Production and consumption of barley and wheat in England, from 1887 to 1920.*

Period	Wheat		Barley	
	Consumption	Production	Consumption	Production
1887-1891 . . . . .	6.1	2.02	2.56	1.69
1910-1914 . . . . .	6.8	1.60	2.40	1.38
1910-1920 . . . . .	7.4	1.34	1.91	1.32

fall. Barley is specially important in the county of Norfolk where it covers 15 % of the cultivated area, next in Suffolk, Lincolnshire, Rutland, Cambridgeshire and in East Yorkshire, where it occupies 9 to 12 % of the area under crops.

Sunshine probably affects wheat and barley more than absence of rain. Barley differs from wheat in other respects. Barley prefers light soils, wheat heavy soils. In England, barley is sown in spring and wheat in autumn. At Rothamsted, the period of growth for barley is 150 days (from April 1 to August 1), that of wheat 290 days (from the end of October to the middle of August). It is probable that the smaller production of straw and grain by barley compared with wheat, depends on this shorter period. Barley places, in comparison with wheat, a greater proportion of its substance in the grain than in the straw.

TABLE II. — *Distribution of the matter and nitrogen in the straw and grain in barley and wheat.*

Average of harvests (1910-1919) in England

	Dry matter in kg per ha.		Nitrogen in kg per ha.	
	Straw	Grain	Straw	Grain
Barley . . . . .	3 500	2 500	19	45
Wheat. . . . .	4 800	2 200	25	47

Experiments made at Rothamsted from 1852 to 1855 with chemical manures enabled the yield of barley to be increased from 30 to more than 50 bushels per acre.

This was a remarkable result for the period and had a great influence on the development of the Chemical manure industry, which commenced at Rothamsted in a barn, in 1843, and has since attained such huge proportions. The continuation of experiments started at Rothamsted has enabled certain questions to be elucidated, but others still remain obscure. One of the most singular phenomena is the constant decrease of crops, which is



TABLE III. — *Comparative effect of various manures on the grain yield of barley (bushels per acre).*

Without manure . . . . .	29.8
Farmyard manure . . . . .	44
Complete artificial fertilisers :	
With nitrate of soda . . . . .	50.5
" sulphate of ammonia . . . . .	47

specially noticeable on plots treated with chemical manures and slightly less so on those treated with farmyard manure. Table IV shows the number of times that certain yields have been recorded, by decennial periods, on the plots treated with artificial manures. As is seen, good crops go on decreasing and bad crops increasing.

It is difficult to explain this phenomenon. It has been attributed to unfavourable changes in climate or to a supposed secretion of poison by the plant, but nothing has been proved. It has been thought that the commonly accepted list of elements indispensable to nutrition was incomplete : BERTRAND has shown the utility of manganese ; MAZÉ has added to the list boron, fluorine, chlorine, aluminium and zinc. BRENCHELY at Rothamsted, confirmed the utility of manganese and of boron in small quantities ; in large quantities it became injurious. It might therefore be supposed that the lack of these elements in ordinary artificial manures might slowly exhaust the reserves in the soil while there would be a certain amount of them in farmyard manure, but objections are raised against that opinion.

TABLE IV. — *Frequency of certain yields of barley from 1852 to 1921.*

Periods	Bushels per acre					
	60-70	50-60	40-50	30-40	20-30	10-20
1852-1861 . . . . .	1	3	3	3	—	—
1862-1871 . . . . .	—	2	6	2	—	—
1872-1881 . . . . .	—	2	3	4	1	—
1882-1891 . . . . .	—	2	4	3	1	—
1892-1901 . . . . .	—	1	4	2	3	—
1902-1911 . . . . .	—	1	3	5	1	—
1912-1921 . . . . .	—	—	1	5	1	1

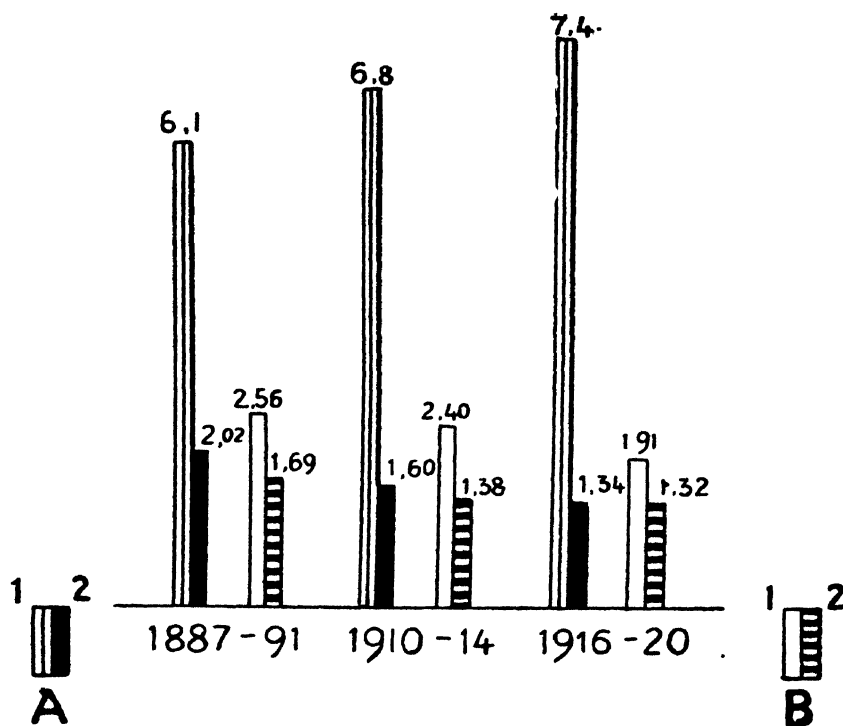
It might also be thought that the addition of an electrolyte disturbs the colloidal properties of the soil. At Rothamsted the problem is subjected to systematic research.

Fortunately this phenomenon does not occur in the general English crop ; the average crop in that country has even increased slightly :—

1887-1896 . . . . .	33 16 bushels per acre
1897-1906 . . . . .	33 64 " " "
1907-1916 . . . . .	33 67 " " "

The heaviest crop recorded by the writer was 80 bushels per acre. Two factors prevent barley from reaching that figure :— the season

FIG. 1. — *Production and consumption of wheat and barley in England, in millions of tons per annum.*



EXPLANATION .

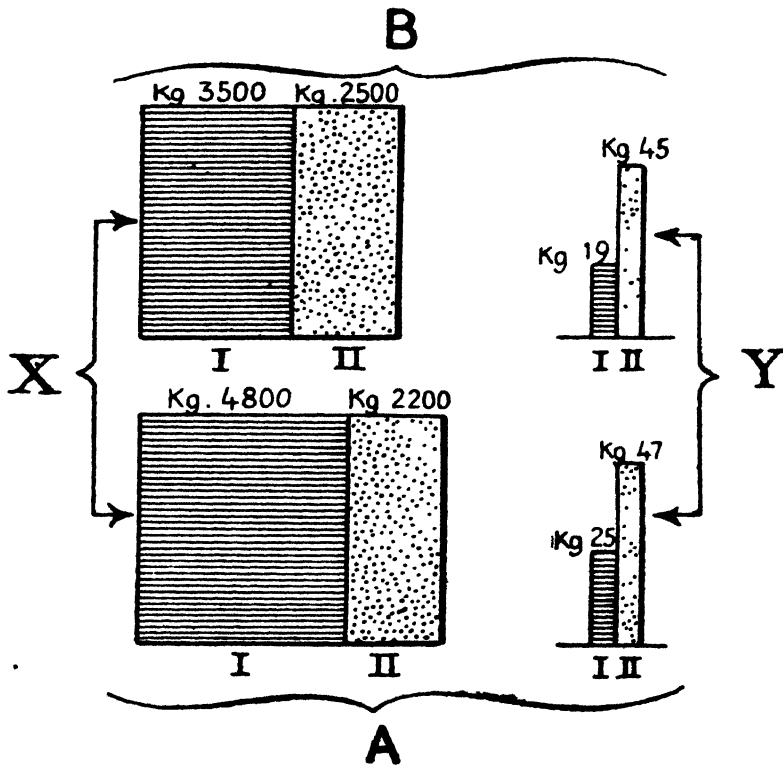
A = wheat ; 1 — consumption , 2 = production

B = barley ; 1 = consumption ; 2 = production

and the strength of the straw, which is often incapable of supporting a very large weight of grain

The problem of the strength of the straw is one of the most serious and urgent problems ; it is partly physiological and partly genetic, and we have scarcely anything but a little empiric knowledge of it. It may depend on chemical changes, mechanical arrangements of the tissues or on the osmotic pressure of the cell sap.

So long as we have not been successful in producing varieties of barley with much stronger straw there is no use in stimulating the development of the grain to the utmost by means of artificial manures. There are, besides, other factors which restrict the growth of barley:— insufficient rainfall, temperature, incapacity of the plant to utilise the whole of the solar energy. From an industrial standpoint, quality is still more im-



## EXPLANTTION :

A = wheat ; B = barley ; X = dry matter in kg per ha ; Y = nitrogen in kg. per ha ; I = straw ; II = grain

portant than quantity. The percentage of nitrogen is not much affected by manures. By potash and phosphate manuring the carbo-hydrate content is easily increased without increasing the nitrogen content. On the other hand, the latter is very much affected by climatic conditions. Generally the nitrogen content is inversely proportional to the yield in grain.

The Rothamsted experiments have proved the falseness of the opinion according to which, during maturation, plants supply the grain first with nitrogen and afterwards with carbo-hydrates.

Very little has been added to the classic works of MUNRO and BEAVEN

on the aptitude of barley for brewing. The nitrogen content may be used as an indication of that aptitude, as it is more or less inversely proportional to it. In this there is no really causal relation : a good quality barley has a large proportion of endosperm as compared with embryo ; this happens when climatic conditions have been good during the second part of the life of the plant, and generally implies a low nitrogen content, because the nitrogen is absorbed, for the greater part, at the commencement of growth.

The British Institute of Brewing has just undertaken very extensive research on the relation of good quality of barley and its agricultural conditions and it is hoped that they will throw much light on this important question. Five series of plots have been prepared :— 1) without manure ; 2) complete artificial manures ; 3) artificial manures containing no potash ; 4) artificial manures containing no phosphate ; 5) artificial manures containing no nitrogen. Complete analyses of samples of the barley grown will then be made.

Another problem, more difficult to solve, is at present under examination : it concerns the influence of the soil and season on the quality of the barley. Lastly, the Institute has just come to another serious question : the chemical composition of a good quality barley. But the final solution of this problem requires biochemical knowledge not yet possessed.

The Institute has the great merit of having set up co-operation between brewers, barley growers, agricultural experts and chemists. Such co-operation is no doubt destined to give the best results. A. de B.

1291 - **Rice Planting in Sarawak.** — *Journal of the Royal Society of Arts.* Vol. LXX, No 3644, pp. 766-767. London, September 22, 1922.

Of the many different tribes inhabiting Sarawak all cultivate rice with the exception of the nomadic tribes of the far interior. The methods adopted vary slightly but are for the most part of a primitive order. The inland tribes mostly cultivate " hill " rice, and for this purpose clear and destroy large quantities of valuable timber every year by cutting and burning. " Hill " land that has been farmed is allowed to lie fallow for at least seven years and " wet " land for three years.

The planting is done at the end of the dry season, about July and August, so that the growing crops may have the benefit of the rains and the grain have a chance of ripening in the beginning of the next fine season, about April or May. If old jungle is cleared the clearing is commenced about May or June in order that the timber may have time to dry before the burning time.

Buffaloes are not used for preparing the ground except by the tribes living in the districts adjacent to Brunei and also by the tribes inhabiting the highlands at the head waters of the Baram, Limbang and Trusan rivers.

**SOWING.** — The seed of the hill padi is planted in holes about 1" to 18" apart made by a blunt pointed stick. Three or four seeds are dropped

into each hole and covered by scraping earth or ashes over the hole with the foot.

Marsh padi is either broadcasted or transplanted. If old jungle has been cleared the seed is usually broadcasted, but otherwise it is transplanted from nurseries when about 6" high into holes drilled with a pointed stick.

The farms are strongly fenced to keep out the wild pig and deer immediately after the padi commences to grow.

The weeding is usually left to the women and children whilst the men go hunting or in search of jungle produce.

**CATCH CROPS.** — Immediately after the burning, tobacco, maize, cucumbers, bayam, egg plants, etc. are planted wherever the wood ashes are thickest. These ripen and are eaten before the harvest. Millet is also planted on the edges of the paths and at the edges of the farm. This is done partly to keep the monkeys occupied till the owner arrives and drives them away.

**THE HARVEST.** — The heads of the padi seldom ripen all together; consequently the crop is not reaped all at once, but the ripe heads are collected. The Dayaks do not use knives but strip the ripe heads with their fingers.

The padi is stored sometimes in the houses in receptacles made of the bark of large trees and sometimes in specially constructed granaries. When it is desired to convert the padi into rice it is pounded in mortars or put through a husker and then winnowed.

Crops vary greatly in quantity, the following being the usual causes of failure: an unsuccessful burning of the clearing, insufficient rain at the planting season, insufficient sunlight during the ripening period, depredations of wild animals, rats and mice, attacks of insects, etc.

The use of large quantities of rice in the making of spirituous drinks amongst the non-Mohammedan tribes, «tabus» observance and feasts result not infrequently in a shortage of rice.

In the absence of reliable statistics it is impossible to estimate the average yield, but a fair average for hill padi would probably be about 30 fold and for swamp padi about 70 to 100 fold.

G. A. B.

1292 — **Food Pulse Crops in Morocco.** — *Annales de l'Institut Colonial de Bordeaux*, pp. 139-144. Paris-Bordeaux, May 1922.

**BEANS.** — These are of good quality; the Safi variety, with small seeds and richer in gluten, have a higher value than the large beans of Casablanca and Magazen.

The areas under beans from 1915 to 1921 were as follows:—

Year	Area
1915 . . . . .	28 576
1916 . . . . .	38 097
1917 . . . . .	39 176
1918 . . . . .	64 850
1919 . . . . .	68 315
1920 . . . . .	66 536
1921 . . . . .	59 638

Beans are sown in rows, at the beginning of the autumn rains ; the green pods are gathered in April and the dry seed in May.

Experiments made in 1916-1917 with the Seville bean, an early variety with fairly long pods, yielded 14.7 qx. per ha. ; those of 1917-1918, 21 qx. per ha. The large broad-bean, in spite of adverse circumstances, yielded 12 qx. per ha. Several diseases of vegetable and animal origin may injure the crop : the average yield per ha. in 1921 for the whole of Morocco was 8.2 qx. Part of the yield is eaten by the natives, but the greater part is exported.

*Export of beans from ports in the French zone of Morocco, during 1921.*

January . . . . .	1 942 267 kg
February . . . . .	368 918 "
March . . . . .	294 195 "
April . . . . .	248 094 "
May . . . . .	652 454 "
June . . . . .	10 206 539 "
July . . . . .	14 582 346 "
August . . . . .	8 881 265 "
September . . . . .	16 285 444 "
October . . . . .	2 624 483 "
November . . . . .	2 962 310 "

CHICK-PEAS. — These are grown in the southern regions ; they are sown in deep soils because of their large deep root system and grow fairly well in dry climates ; the areas sown during the past few years have varied as follows:—

1915 . . . . .	16 305 ha
1916 . . . . .	21 236 "
1917 . . . . .	22 525 "
1918 . . . . .	32 150 "
1919 . . . . .	29 870 "
1920 . . . . .	27 341 "
1921 . . . . .	32 277 "

In 1921, the average yield was 7 qx. per ha. The chick-peas are passed through a sieve and classed in three divisions bearing the numbers 27 — 28 — 29, the higher number indicating better quality.

*Exports of chick-peas from Morocco from 1915 to 1921.*

Years	Quintals	Francs
1915 . . . . .	61 994	1 859 820
1916 . . . . .	52 326	1 865 860
1917 . . . . .	58 650	3 602 931
1918 . . . . .	40 964	2 250 481
1919 . . . . .	176 920	14 666 678
1920 . . . . .	63 970	8 234 021
1921 (up to November) . . . . .	169 263	—

**LENTILS.** — The native varieties are small but very fine and very suitable as food for Europeans. The development of their cultivation from 1915 onwards is shown by the following figures. —

1915 . . . . .	35 ha.
1916 . . . . .	730 "
1917 . . . . .	941 "
1918 . . . . .	2 453 "
1919 . . . . .	7 692 "
1920 . . . . .	5 993 "
1921 . . . . .	5 216 "

Clay soils cannot be used for growing lentils ; they are gathered in July and in 1918, the average yield was 9 qx. per ha. at Marrakesch, and in 1920, 6 qx. at Fez, although the gathering was done under unfavourable conditions.

*Exports of lentils from Morocco, from 1915 to 1921.*

Years	Quintals	Francs
1915 . . . . .	1	25
1916 . . . . .	1 019	49 058
1917 . . . . .	1 265	78 617
1918 . . . . .	5 838	516 027
1919 . . . . .	38 452	3 667 945
1920 . . . . .	42 842	4 583 460
1921 (up to November) . . . . .	42 512	—

The prices varied between 35 and 100 fr. per quintal.

**FENUGREEK** (*Trigonella*). — The seeds of this leguminous plant are used by Orientals as a condiment ; they are also used for fattening animals but they give the meat a disagreeable taste ; they form an ingredient in poultices. Sowing is done in autumn on low moist ground, 20 kg. of seed being used per ha. ; the crop is gathered in June-July and in 1921, the average yield was 2 qx. of seed per ha.

*Exports of fenugreek seed from Morocco, from 1915 to 1920.*

Years	Kilogrammes	Francs
1915 . . . . .	3 459 604	61 113
1916 . . . . .	1 359 554	428 401
1917 . . . . .	1 952 718	2 290 332
1918 . . . . .	5 651 920	4 374 450
1919 . . . . .	3 664 399	1 695 878
1920 . . . . .	11 205 262	5 079 232

On December 1, 1921 the price of fenugreek seed varied between 35 and 44 fr. per quintal.

1293 - **Effect of different Reactions on the Growth of Soy Beans and the Formation of Nodules.** — BRYAN, O. C. (Wisconsin Agricultural Experiment Station), in *Soil Science*, Vol. XIII, No. 4, pp. 271-302, 15 pl., bibliography of 39 publications. Baltimore, Apl. 1922.

The reaction with which leguminous plants grow and are best inoculated has yet to be ascertained. The writer made a series of experiments in order to solve the question in the case of the soy bean, of which he prepared many cultures in saline solution and in sand, in vessels of 500 to 600 cubic cm. capacity. The reaction of the solutions was regulated by adding alkalis or acids and maintained constant by changing the solutions daily. The plants were allowed to grow for 25 to 35 days after inoculation. Other cultures of maize and cowpeas were made under similar conditions to those of soy beans, for comparison. Moreover 21 cultures of the same number of species of soy bean bacteria were prepared so as to be able, after 15 or 20 day's incubation, to compare the critical concentration of the hydrogen ions for soy bean bacteria and for the plants which harboured them.

SHIVE'S nutritive solution proved favourable to the growth and inoculation of soy beans in the sand cultures, but not in the aqueous cultures. Perhaps there may have been poisonous impurities in the salts of the solution which were absorbed by the sand. CRONE'S solution proved suitable for all the cultures; its "cushion effect", that is to say its aptitude for resisting changes of pH, was improved by the addition of 0.75 gm. of carbonate of soda per litre.

The reaction of the solution in contact with the plant does not remain constant except in the case of the reaction most favourable to its growth. Changes take place more rapidly in alkaline solutions and with plants which grow quickly. The reaction most favourable to growth and inoculation of soy beans was  $\text{pH} = 6.5$ . The limits of pH between which inoculation took place were 4.6 and 8. The limits for the growth of soy beans were 3.9 and 9.6. Reactions in which  $\text{pH} = 4.95$  and 8.2 are injurious to the growth of soy beans, but do not completely prevent inoculation.

The values of pH which proved decidedly injurious were not generally greater, but often very much less than values given by soils considered to be very acid.

The critical concentration of hydrogen ions for the formation of nodules on soy beans was slightly less than that for its growth. The different cultures of bacteria showed a slight difference as regards the critical value of pH.

Maize grows within much wider limits than soy beans and cowpeas. The cowpeas seem to have wider limits than soybeans regarding the formation of nodules. The reaction of the vegetable sap was, generally, equal to that of the nutritive solution, except for the leaves of maize which showed a certain difference. The sap of the roots followed the reaction of the medium more closely than that of the leaves.

A. de B



1294 - **Good Forage Grasses of Southern Rhodesia.** — MUNDY, H. G. (Chief Agriculturist and Botanist), in *Department of Agriculture, Salisbury, Rhodesia, Bulletin* No. 417, 17 pp., 8 full page tabl. Salisbury, 1922.

FORAGE CROPS

Since 1911 the Department of Agriculture in Rhodesia has carried out experiments with good forage plants suitable for cultivation in that country, that is to say already acclimatised or capable of acclimatisation, which stand cold and drought and are eaten by cattle and are nutritious. After a few years it was noticed that as a rule, the most highly recommended exotic forage plants did not thrive under the new con-

*Percentage composition of various forage grasses growing in Rhodesia.*

Species	Moisture	Fat (ether extract)	Crude protein	Non nitrogenous extracts	Crude cellulose	Ash	Pure protein	Total nitrogen	Protein nitrogen	Actual protein per 1000 kg. of dry matter
	%	%	%	%	%	%	%	%	%	kg.
<b>BEFORE FLOWERING :</b>										
<i>Setaria Lindenberghiana</i> . . . . .	10.66	3.48	16.38	33.69	24.10	11.69	14.06	2.62	2.25	157
<i>Phalaris bulbosa</i> . . . . .	10.51	2.91	15.62	40.45	21.30	9.21	11.56	2.50	1.85	129
<i>Pennisetum clandestinum</i> . . . . .	8.40	2.38	12.12	41.91	25.42	9.77	10.31	1.94	1.65	112.5
« Penhalonga » grass. . . . .	11.28	2.45	11.81	39.74	25.95	8.77	9.06	1.89	1.45	102
<i>Brachiaria brizantha</i> . . . . .	9.99	2.17	12.69	40.74	21.96	12.45	8.75	2.03	1.40	97
<i>Hemarthra fasciculata</i> . . . . .	8.47	1.72	7.31	46.27	29.77	6.46	6.88	1.17	1.10	75
<b>WHEN FLOWERING .</b>										
<i>Panicum maximum</i> . . . . .	10.04	1.61	10.94	36.04	32.60	8.77	10.00	1.75	1.60	111
<i>Setaria sulcata</i> . . . . .	9.81	1.91	13.31	37.80	27.38	9.79	10.00	2.13	1.60	111
<i>Setaria aurea</i> . . . . .	8.30	2.62	14.12	36.74	26.73	11.49	10.00	2.26	1.60	109
<i>Brachiaria brizantha</i> . . . . .	9.48	1.95	10.25	35.79	33.07	9.46	9.69	1.64	1.55	107
<i>Eustachys petrea</i> . . . . .	11.25	2.98	10.25	39.46	28.25	7.81	9.06	1.64	1.45	102
<i>Echinochloa pyramidalis</i> . . . . .	9.22	1.83	11.37	36.24	32.86	8.48	9.06	1.82	1.45	99.5
<i>Cynodon plectostachyum</i> . . . . .	9.79	1.60	8.62	48.07	26.52	5.40	5.62	1.38	0.90	62.5
<b>PLANTS WITH FLOWERS AND SEEDS :</b>										
<i>Paspalum virgatum</i> . . . . .	9.19	2.64	9.06	39.32	32.70	7.09	8.44	1.45	1.35	91.5
<i>Paspalum scrobiculatum</i> . . . . .	11.22	2.25	8.62	46.64	23.90	7.27	8.13	1.38	1.30	91.5
<i>Cynodon plectostachyum</i> . . . . .	8.58	1.63	9.06	46.47	28.17	6.09	7.81	1.45	1.25	85.5
<b>HAY :</b>										
<i>Paspalum scrobiculatum</i> . . . . .	10.38	1.95	7.00	45.88	27.13	7.66	6.88	1.12	1.10	76.5
<i>Pennisetum unisetum</i> . . . . .	7.82	1.49	7.31	40.16	34.20	9.02	6.56	1.17	1.05	71
<i>Brachiaria brizantha</i> . . . . .	10.29	2.33	8.44	41.44	26.75	10.75	6.25	1.35	1.00	69.5
<i>Chloris Gayana</i> . . . . .	8.43	2.07	8.50	38.47	33.09	9.44	5.94	1.36	0.95	65
<i>Setaria aurea</i> . . . . .	8.57	1.91	6.25	36.83	36.62	10.22	5.31	1.00	0.85	58
<i>Tricholaena rosea</i> . . . . .	7.58	1.59	5.69	41.52	36.82	6.80	5.31	0.91	0.85	57.5
<i>Paspalum virgatum</i> . . . . .	8.90	2.20	4.69	42.60	34.97	6.64	4.38	0.75	0.70	48
<i>Tricholaena setifolia</i> . . . . .	8.93	2.31	5.81	40.31	34.85	7.79	4.06	0.93	0.65	44.5

ditions of their environment or else lost their qualities, while good results could be obtained by systematic selection of indigenous forage plants.

At present the following are being tested at Salisbury:— 55 indigenous species or subspecies — 10 African, but not Rhodesian, species. From their behaviour on dioritic red soils of medium texture, in Masbongaland, it is recommended to make meadows with the following species, the botanical description and cultural characteristics of which are given:—

INDIGENOUS TO RHODESIA. — “Rhodesian tussock grass” (*Setaria Lindenberghiana*) — “Pehalonga grass” — “False paspalum” (*Brachiaria brizantha*) — “Swamp couch grass” (*Hemaphysaria fasciculata*) — “Fine Guinea grass” (*Panicum maximum*) — “Buffalo grass” (*Setaria sulcata*) — “Golden timothy grass” (*Setaria aurea*) — “Red Rhodes grass” (*Eustachys petrea*) — “Antelope grass” (*Echinochloa pyramidalis*) — “Tall couch grass” (*Cynodon Dactylon*) — “Native paspalum” (*Paspalum scrobiculatum*) — “Common red top grass” (*Tricholaena rosea*) — “Bristle leaved red top” (*Tricholaena setifolia*).

EXOTICS. — “Kikugu” (*Pennisetum clandestinum*) — “Natal grass” (*P. unisetum*) — “African Star grass” (*Cynodon plectostachyum*) — “Perennial canary grass” (*Phalaris bulbosa*) — “Upright paspalum” (*Paspalum virgatum*) — “Rhodes grass” (*Eustachys Gayana*).

The composition of these grasses (air dried samples) and of the hay obtained by cutting them at the moment when they flowered is given in the Table at page 1487. F. D.

1295 — Species of *Rumex* in Grass-lands. — ROGER, R., in *Journal d'Agriculture pratique*, 86th Year, Vol. II, No. 32, pp. 131-134, 1 fig. Paris, Aug. 12, 1922

In the grass-lands of the East of France, and probably also in those of other regions, an exceptionally abundant invasion of large species of *Rumex* (*R. nemorosus*, *R. conglomerata*, *R. palustris*, etc.) occurred during 1922, thus adding to the depreciation caused by wild sorrel (*R. acetosa*) in the food value of the forage and threatening, unless energetic control measures are taken, to render in a few years the produce of the infested grass-lands quite unusable, except as inferior litter. All large species of *Rumex* are as a matter of fact rejected by cattle, both in a green state and when mixed in dry fodder, and their presence in a grass field will always be a cause of depreciation in the value of the produce.

On the other hand these plants are perennial and exceedingly prolific, so that it is difficult to keep them out.

The cause of the invasion appears to be as follows. The drought of 1921, paralysing the growth of forage plants, caused many farmers to give up to grazing a certain number of meadows usually kept for mowing and, as the cattle left the *Rumex* alone, these undesirable plants remained, withstood the drought owing to their deep taproots, and were able to grow quite freely, to fructify and to ripen their innumerable seeds. The seeds being light and winged, as a result of the persistence of the developed floral envelopes, were scattered by the wind over a large area all round the mother plant.

In certain cases, floods have assisted the wind and carried the injurious seeds to great distances and grass-lands previously free from the weed have become infested. In 1922 as the hay season approached the farmers were greatly and disagreeably surprised when they saw the tall rust coloured racemes of the invaders. The more prudent anticipated the usual time of mowing, so as to prevent the plants from ripening their seed and extending their ravages further by self propagation. This was however exceptional and most of the infested meadows were cut at the ordinary time.

Early mowing, which generally suffices to get rid of annual species which are undesirable in a meadow, seems the only efficient remedy. Unfortunately in this case it only served to prevent the invasion from spreading by stopping the multiplication of the large species of *Rumex*, which are almost all perennial. Moreover this quality of persistence resists the use of liquid weed-killers.

To eliminate these obstructive and injurious weeds it was found necessary to destroy them plant by plant either by pulling them up or by cutting the roots, in two places. The best time for uprooting appears to be at the end of May or early in June, when the plant owing to its height is easily seen above the grass. If the operation is done after rainy weather, when the moist earth holds the roots less firmly, a good pull on the stalk is sufficient to uproot the plant ; if this is not the case a well applied stroke of a spade will sever the root and enable the plant with the part of the root above the point of section to be removed.

However carefully the work is done a certain number of plants may escape destruction and threaten, by seeding, to reduce the effect. Cutting down at a suitable time will prevent seed ripening and seed propagation, and, if care is taken in the following year to root up the plants previously overlooked, in the end the field will be freed. But it will always remain subject to fresh invasion for no meadow is safe.

While the fiddle dock (*R. pulcher*) and the curled dock (*R. crispus*) grow mainly in well drained and even dry meadows, the wood dock (*R. nemorosus*) and the broad dock (*R. obtusifolius*) establish themselves indiscriminately on all kinds of ground and they all readily take their chance on moist bottoms, such as are preferred by the marsh dock (*R. palustris*) and the water dock (*R. hydrolapathum*). It would be wise to watch all meadows carefully so as deal with the weed as soon as it appears. Such watchfulness will be all the more desirable if the meadow is close to uncultivated land where weeds grow and multiply freely. In such cases it would be a good preventive measure to cut the *Rumex* plants growing on such land before their seed ripens.

L. V.

1296 - Effect of Crude Phosphates and Basic Slags on the Quality of Hay and Pastures. — ROBERTSON, G. S., in *The Journal of the Ministry of Agriculture*, Vol. XXIX, No. 3, p. 600-605, 1 fig. London, Oct. 1922.

The most important indirect effect caused by the application of basic slags to pastures, is the great improvement in the quality and nutritive value of the forage. A certain quantity of hay obtained from land treated

with slags has a much greater nutritive value than the same quantity of hay obtained from untreated land. The Cockle Park experiments have caused this increase to be valued at 13 shillings a ton, on a basis of pre-war prices.

TABLE I. — *Botanical composition of the hay.*

	Plot I Open Hearth slag (fluoritic)	Plot II Open Hearth slag (very soluble)	Plot III Without manure	Plot IV Gafsa mineral phosphate	Plot V Egyptian mineral phosphate	Plot VI Algerian mineral phosphate
	%	%	%	%	%	%
Leguminous plants . . . . .	traces	traces	traces	traces	traces	traces
Grasses . . . . .	85.2	88.1	58.5	82.6	96.7	95.8
Weeds . . . . .	14.8	11.9	41.5	17.4	3.3	4.2

TABLE II. — *Composition of the grasses by weight.*

	Plot I Open Hearth slag (fluoritic)	Plot II Open Hearth slag (very soluble)	Plot III Without manure	Plot IV Gafsa mineral phosphate	Plot V Egyptian mineral phosphate	Plot VI Algerian mineral phosphate
	%	%	%	%	%	%
<i>Lolium perenne</i> . . . . .	9.9	22.0	6.8	26.9	19.8	17.0
<i>Phleum pratense</i> . . . . .	6.0	7.7	2.8	4.5	5.7	1.9
<i>Cynosurus cristatus</i> . . . . .	20.6	14.7	10.8	25.2	28.7	10.6
<i>Poa trivialis</i> . . . . .	1.3	12.0	0.6	10.9	7.3	9.5
<i>Avena flavescens</i> . . . . .	1.3	1.4	0.6	1.0	1.3	0.6
<i>Festuca ovina</i> . . . . .	—	0.9	—	—	—	—
<i>Holcus lanatus</i> . . . . .	32.5	29.7	44.3	18.0	17.0	29.0
<i>Agrostis alba</i> . . . . .	0.7	2.6	6.8	4.5	4.8	11.2
<i>Anthoxanthum odora-</i> <i>tum</i> . . . . .	27.7	9.0	27.3	9.0	15.4	20.2
	100.0	100.0	100.0	100.0	100.0	100.0
Tall grasses . . . . .	39.1	58.7	21.6	68.45	62.8	39.6
Short grasses . . . . .	60.9	41.3	78.4	31.55	37.2	60.4

It is therefore very important to know whether the new types of basic slags and other substitutes have a corresponding influence on the crop. In experiments made at Martins Hearne, in 1917 and 1918, clover made great growth on manured plots and especially on those to which were

applied the very soluble slag and the mineral phosphates, particularly Gafsa mineral phosphate. In the dry season of 1919, clover did not appear either on the manured plots or on the others; however, the former were always distinguished by bright colour and a double crop of hay.

The Gafsa and Egyptian mineral phosphates have similar efficiency to that of very soluble basic slags, while the efficiency of fluoritic slag is much less and that of Algerian phosphate is the least of all. In 1920, the leguminous plants again grew well and equally so on the plot manured with very soluble slag and on that manured with phosphate.

TABLE III. — *Composition of hay in 1920.*

	Plot II (very soluble basic slag)	Plot III (without manure)	Plot IV (Gafsa mineral phosphate)
	%	%	%
Leguminous plants . . . . .	27.5	11.2	35.0
Grasses . . . . .	63.0	53.5	54.2
Weeds . . . . .	9.5	30.3	10.8

Other experiments made at Horndon, by manuring in February 1918 and by analysing the soils in August 1919, gave the results shown in Table IV.

TABLE IV. — *Percentages of space occupied by vegetation in the Horndon plots.*

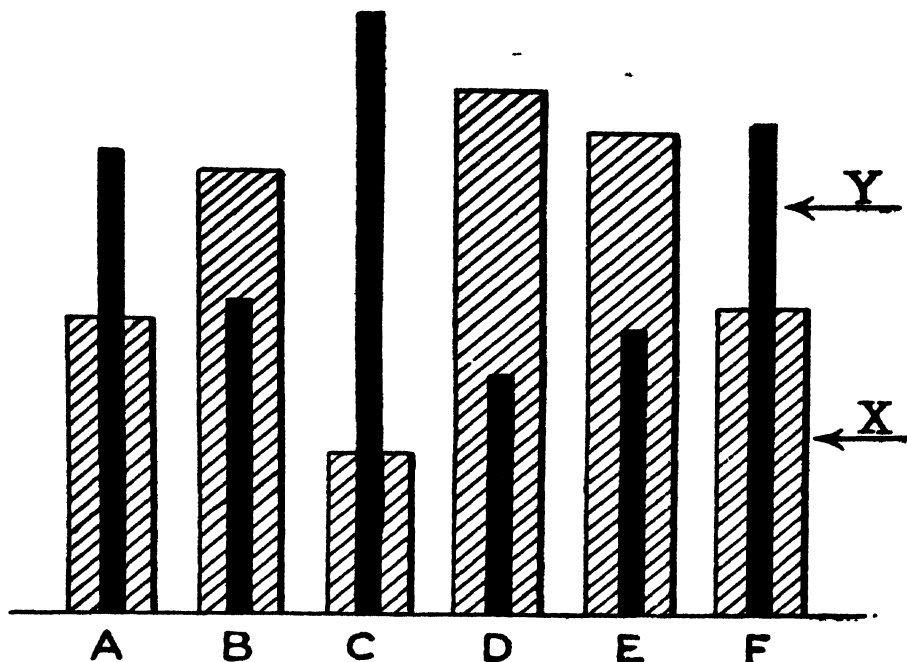
Plots	Manure (220 kg. of phosphoric acid per ha)	Legumi- nous plants	Grasses	Weeds	Basic space
		%	%	%	%
C.	Lime only, . . . . .	15.1	34.6	30.0	20.3
1	Florida "pebble" phosphate . . . . .	46.0	30.6	13.3	10.1
3	Algerian phosphate . . . . .	47.4	30.1	7.4	15.1
5	Very soluble Open Hearth slag, . . . . .	44.1	28.6	13.7	13.6
6	Without manure . . . . .	4.2	14.8	31.0	50.0
8	Gafsa phosphate . . . . .	41.3	32.3	17.6	8.8
9	Tunisian phosphate . . . . .	38.5	36.9	21.0	3.6
12	Egyptian phosphate . . . . .	55.5	41.10	10.7	2.8
13	Superphosphate (220 kg. of $P_2O_5$ per ha) . . . . .	23.9	57.3	0.7	18.1
14	Superphosphate (55 kg. of $P_2O_5$ per ha) . . . . .	18.8	25.3	18.8	37.9
15	Superphosphate (as in 13) + 2.5 <sup>t</sup> of lime per ha. . . . .	60.0	32.7	1.4	5.9
16	Without manure . . . . .	9.4	19.1	26.0	45.5
17	Very soluble Open Hearth slag (as in 5) . . . . .	46.2	47.2	1.4	5.2
18	Open Hearth fluoritic slag . . . . .	43.8	31.8	13.3	11.1
H	Cleveland phosphate . . . . .	43.1	33.3	5.6	18.0

These results and those obtained the following year with hay enable the 4 following important conclusions to be drawn :—

1) Various basic phosphates (mineral phosphates, very soluble or slightly soluble slags, basic superphosphates) produce the same kind of improvement and to an equal extent.

2) By comparing the above results with those obtained the following year with hay, it is noticed that there is no close relation be-

*Influence of phosphate manures on the composition of the hay.*



**EXPLANATION :**

Y = weights of tall grasses ; X = weights of short grasses.

A = manuring with slightly soluble basic slags ; B = manuring with very soluble slags ; C = control ; D = Gafsa crude phosphate ; E = Egyptian crude phosphate ; F = Algerian crude phosphate.

tween the two and the former results do not enable the latter to be estimated. For example, of plots 17 and 18, which were almost equal as regards quality of pasture, plot 17 yielded about twice as much hay as 18 in the following year.

3) In soils poor in lime, superphosphate has an unsatisfactory effect, especially on leguminous plants, while it acts better on grasses. If mixed with lime, thus forming "basic superphosphate", it is even more stimulating to leguminous plants than basic phosphates.

4) Lime alone is of no use on such soils.

A. de B.

1297 - **Fibre Crops in Morocco.** — *Annales de l'Institut Colonial de Bordeaux*, pp. 207-211. Paris-Bordeaux. July-Aug. 1922.

TEXTILE  
AND  
FIBRE CROPS  
ETC.

**FLAX.** — The growth of flax for linseed has been in vogue for a very long time in Morocco, especially in the districts of Chaouia and the Doukkalas, but is capable of extension in other districts. Flax grows well on deep siliceous-clay soils and a previous crop of beans or chick-peas is very favourable to it. Sowing takes place in October, although many farmers persists in sowing in February. Table I gives the experimental data collected by the Director of Agriculture regarding the yield of linseed per hectare in relation to the time of sowing.

TABLE I. — *Yield of linseed in relation to time of sowing.*

Variety	Date of sowing	Yield per ha. quintals
Indigenous flax . . . . .	29 January	39.25
Northern flax . . . . .	30 " "	35.85
Normandy flax . . . . .	26 February	40.75
Northern flax . . . . .	27 " "	37.05
Riga flax . . . . .	3 March	51.76
Normandy flax . . . . .	25 February	23.50

In 1921 the average yield of linseed per hectare for the whole of Morocco was 6 %.

TABLE II. — *Areas under flax from 1915 to 1921.*

1915 . . . . .	4 867 ha.
1916 . . . . .	3 306
1917 . . . . .	5 251
1918 . . . . .	15 812
1919 . . . . .	28 955
1920 . . . . .	39 910
1921 . . . . .	17 870

In consequence of the suppression of the export of Russian flax, means were sought for utilising the stalks of Moroccan flax and satisfactory results were obtained. The exports of the products are shown in Table III.

On January, 1922 the value of linseed per quintal varied between 60 and 80 fr.

**HEMP.** — The growth of this crop, which was very restricted at the beginning of the war, increased during the war owing to high prices. Hemp grows well on deep, moist, light soils, and especially on alluvial soils. The Mesfiousas, who have grown hemp for a very long time, spread the manure with the greatest care and as a rule irrigate every 8 or 10 days.

TABLE III. — *Export of linseed and flax stalks from Morocco from 1915 to 1920.*

Years	Kilogrammes	Francs
<i>Linseed.</i>		
1915 . . . . .	7,134,334	2,282.987
1916 . . . . .	2,076,706	1,221,943
1917 . . . . .	4,293,130	5,511,274
1918 . . . . .	3,877,844	4,155,375
1919 . . . . .	16,591,023	21,044,162
1920 . . . . .	17,921,773	24,944,227
<i>Flax stalks.</i>		
1915 . . . . .	13	12
1916 . . . . .	50,758	43,187
1917 . . . . .	207,251	318,622
1918 . . . . .	217,608	647,043
1919 . . . . .	483,384	1,447,039
1920 . . . . .	526,430	1,591,229

Statistical data are scarce and incomplete. On January 1, 1922, the prices varied between 60 and 80 fr. per quintal for hempseed and 450 fr. per quintal for tow.

F. C.

1298 - **Cotton in French Africa.** — I *Annales de l'Institut Colonial de Bordeaux*, pp 145-146. Paris-Bordeaux, May 1922. — II MARION, A G, *Ibidem*, June 1922

I. — The production of cotton in the Ivory Coast, from 1913 to 1920, was as follows :—

1913 . . . . .	18 221 kg.
1914 . . . . .	73 435 "
1915 . . . . .	94 840 "
1916 . . . . .	357 597 "
1917 . . . . .	148 038 "
1918 . . . . .	434 091 "
1919 . . . . .	336 263 "
1920 . . . . .	207 999 "

But native-grown cotton is not ginned ; it has therefore only a small market value, since it cannot be exported to Europe.

For this reason the Administration of the Colony, in agreement with the Cotton-growers Association has started establishments for ginning and baling cotton. The rainfall in the Ivory Coast Colony is however, excessive for cotton and in years when there are heavy early rains the fibre is spoiled before it ripens and is gathered. Considered as a secondary crop in association with native-grown yams and sweet potatoes it may have a certain



value for the people of the country. It is estimated that there might be an export of 1200-1500 tons of cotton in excess of the quantity utilized locally by the natives.

II. — In Central Logone, the growth of cotton is still in an elementary state because there are no means of transporting the produce from the Colony. The Central African Company has planted cotton fields on the banks of the Mayo-Kabi, at Léré, but the transport of the cotton to Europe is not easy, as the steamers of the Niger Company only get as far as Garna when the river is in flood; when Garna is connected by rail with Dusla this difficulty will be removed and it will be possible to introduce cotton into the whole of the Tchad region. The area between the Chari and the Logone, south of the extreme limit of the annual floods, is one of the most suitable districts for cotton growing the soil there is light, in some places sandy clay rich in humus. Experiments made in 1920 gave good results although made late and with unselected seed. The cotton is of long silky staple, strong and is similar to that of Dahomey. Over 200 ha have been planted, but it will be necessary to get over the apathy of the natives who will not have anything to do with crops other than their primitive cultivation of millet, sesame and groundnuts. Moreover the population is scanty owing to diseases.

To instruct the natives in agriculture, the writer has organised, near Behagee, a school-farm to which each village will send one of their best men. The natives will there learn how to plough, the value of dung as manure, methods of growing cotton and picking it so as to avoid soiling the produce. Meanwhile the climatic and surrounding conditions will be studied, the most favourable times for sowing and picking will be ascertained, seed for distribution to villages will be selected so that when the Tchad district is connected with the coast by railway, this area will be able to supply cotton of a homogeneous type, suitable for the European markets.

F. C.

1299 — **The Technological Value of the New Hebrides Cottons.** — HEIM, F., and ROERICH, O., in *Bulletin de l'Agence centrale des Colonies*, Year XV, No 160, pp 114. Me'un, January 1922

A study of the characters of two samples of cotton from the New Hebrides that were forwarded for examination to the Laboratory of Colonial Products. Both samples belong to the South American variety *Gossypium peruvianum* Cav.; one was gathered in 1918, and the other in 1920.

The conclusions arrived at by the authors are as follows: New Hebrides cotton will never fetch the price of the best Egyptian varieties. Its tensile strength, owing to the relative thickness of the fibres (a character inherent to the type), is below that of Egyptian cottons and its classification in this respect is low, although the defect could be corrected.

The best qualities are length of fibre and homogeneity. This cotton combines very well with wool for mixed fabrics which are now much manufactured in Paris. Cottons of a woolly type are greatly in request for this

*Technological characters of the two samples.*

Characters	1918	1920
<i>Species</i> . . . . .	<i>Gossypium peruvianum</i>	<i>G. peruvianum</i>
<i>Place of origin</i> . . . . .	New Hébrides	New Hébrides
<i>Length of lint</i> . . . . .	32.5 mm.	34.5 mm.
<i>Average</i> { lower grade . . .	20 mm.	30 mm.
{ upper grade . . .	37 mm.	39 mm.
<i>Fineness of lint</i> . . . . .	22.5 $\mu$	22 $\mu$
<i>Average</i> { lower grade . . .	20 $\mu$	29 $\mu$
{ upper grade . . .	25 $\mu$	25 $\mu$
<i>Extremities</i> . . . . .	fine	fine
<i>Twist</i> . . . . .	P. V. + M. V. = 40 % B. V. + T. V. = 60 %	P. V. + M. V. = 37 % B. V. + T. V. = 63 %
<i>Elasticity</i> { elongation . . .	below 10 % = 45 %	below 10 % = 40 %
{ elongation . . .	above 10 % = 55 %	above 10 % = 60 %
<i>Tenacity</i> . . . . .	8.65 gm.	9.67 gm.
<i>Average</i> { inferior . . . . .	7 gm.	6 gm.
{ superior . . . . .	11 gm.	10 gm.
<i>Tenacity of thread of 0.1 mm.</i> <i>in diameter</i> . . . . .	contains: 19.76 fibres tenacity = 176.84 gm.	contains: 20.66 fibres tenacity = 173.33 gm.
<i>Colour</i> . . . . .	white; very rarely, traces of red.	white: traces of red
<i>Feel</i> . . . . .	woolly	woolly
<i>Defects</i> . . . . .	Some ginning defects; fragments of seeds; fibres soiled with oil.	Imperfect ginning; fibres soiled with oil; fibres brittle owing to bolls being attacked by anthracnose.
<i>Classification</i> . . . . .	Above Middling	Below Middling
<i>Lint yield</i> . . . . .	33.6 %	34.4 %

purpose. The appearance of the cotton gathered in 1918 is superior to that of the 1920 cotton.

The authors advise cotton-growers to take every care to preserve their crop from disease and to keep this variety pure, as it will be appreciated on the market.

F. C.

PLANTS  
YIELDING  
OILS, ETC.

1300 - **Production of Oil Seeds and Vegetable Oils in Bessarabia.** — I. FIORI, M., Statistics of areas sown in Roumania during the agricultural year 1920-1921, in *Buletinul Agriculturii*, Vol. I, No. 1-3, pp. 151-218. Bucharest, January-February 1922. — Statistics of the agricultural year 1920-21, *Ibidem*, Vol. II, No. 4-6, pp. 105-153. Bucharest, April-May-June 1922. — II. The production of oil in Bessarabia in 1920, in *Correspondance Economique*, Bulletin officiel de la Direction générale du Commerce, pp. 12-13. Bucharest, June-July 1922. — III. GURCEA, E., The production of oil in Bessarabia in 1920, in *Buletinul Statisticilor României*, Series IV, Vol. XV, No. 8, pp. 106-107. Bucharest, 1922.

The extent and importance of oil yielding crops in Bessarabia in the agricultural year 1920-1921 are shown by the figures in Table I.

[1899-1900]

TABLE I. — *Area and production of oil yielding crops in Bessarabia, in 1920-1921.*

Crops	Area hectares	% of total crops	Production per hectare hectolitres	Total production hectolitres
Sunflower . . . . .	20 806	0.85	11.6	240 639
Hemp . . . . .	10 704	0.44	5.0	55 655
Linseed . . . . .	2 589	0.11	2.0	5 229
Rape . . . . .	3 239	0.13	1.2	3 773
Poppy . . . . .	18	0.00	7.7	139
Totals . . .	37 356	1.53	—	—

The growth of these crops was divided up among the various classes of agricultural properties in the manner indicated in Table II.

TABLE II. — *Distribution of the oil yielding crops according to the size of properties (hectares).*

Crops	Large properties	Small properties	Peasant Societies
Sunflower . . . . .	3 351	10 622	6 843
Hemp . . . . .	203	5 421	5 080
Linseed . . . . .	416	1 668	505
Rape . . . . .	445	1 966	828

Table II shows that the most important part of the production of oil seeds in Bessarabia belongs to small properties and Peasant societies (1).

The manufacture of vegetable oils has considerable importance especially in the northern part of the Province, namely in the districts of Hotin, Soroka, Bâlti and Orhei.

(1) To give an idea of the development of the growth of oil-yielding crops in Bessarabia during the last 20 years, we take the following data from a recent publication of the International Institute of Agriculture; *Produits oléagineux et huiles végétales, Etude statistique sur leur production et leur mouvement commercial*, Rome 1921:— the annual average area under linseed and hemp for the five years 1901 to 1905 was 10 170 and 5886 ha.; in the following five years the respective figures were 5475 and 4592; in 1913, the last normal year before the war, the area under linseed was 8821 ha.; that under hemp was 6764 ha., and under rape 2585 ha. Regarding the area under sunflower, as data for 1913 are lacking, we give the figures for 1911:— 3421 ha. in the whole Province. A comparison of these figures with those of 1921 shows that the growth of sunflowers has developed more than that of any other oil yielding crop during the last 20 years. (Ed.)

Table III shows, for 1920, the production of vegetable oils in Bessarabia, the quantity required for the consumption of the population and the quantity available for export

TABLE III — *Production, consumption and export (in quintals) of vegetable oils in Bessarabia in 1920*

Oils	Quantity of oil produced	Quantity of oil required for the consumption of the population	Quantity of oil available for exports
Sunflower	17 084	10 921	6 258
Linseed	31	90	1
Hemp-seed	5 432	6 603	213
Coudseed	272	748	16
Colza	166	166	—
<i>Totals</i>	<b>22 985</b>	<b>18 528</b>	<b>6 488</b>

Sunflower oil stands first, the centres of the growth of this crop are the districts of Soroka and Hotin which combined account for 13 463 qx.

The quantities of hemp-seed oil, linseed oil and colza oil in excess of the figures for production and available for export are explained by the fact that stocks of the oils remained over from previous years.

Regarding the methods of oil manufacture in Bessarabia in most cases they are quite primitive and by no means comply with modern technical requirements. Improvement in the methods of production of oils would increase the value of the production, which is already considerable, since in 1911 the total value of all oils produced in Bessarabia was about 33 millions of 'lei'.

I G

1301 — **Growth of the Castor-oil Plant in Morocco.** — CHAVI AU C, in *Le Travail technique et industriel*, Year III No 36 pp 357-391 5 figs. Paris, Sept 1920.

The castor-oil plant is native and very common in the coast zone of Morocco, which proves that the plant can thrive in that area.

Soils known under the names "tell", remel", "hamri" and "sahel" are very suitable for growing the castor-oil plant, for they are rich, especially the last two, in lime and phosphoric acid.

To the "tell" and "sahel" soils, the following mixture has been applied as manure —

Sulphate or nitrate of ammonium	100 kg
Superphosphate	500 "
Sulphate of potash	20 "

In the coast zone, which has an area of from 40 000 to 50 000 ha., the climate is very favourable for growing the castor-oil plant, for the ther-

mometer never falls below  $+1^{\circ}$ , and the heavy night dew renders irrigation unnecessary. In these parts the castor-oil plant lives for about 10 years and assumes arborescent form.

The rainy season, which lasts from November to January, in no way interferes with the flowering and fructification of the plant which takes place from May to October.

Clearing ground costs about 600 fr. per ha., and the cost of manual labour for collecting the seed is not very high. The native castor-oil plant of Morocco belongs to the varieties *Ricinus zanzibarensis* and *R. minor*. These varieties produce seed in undiminished quantity for 5 to 7 years; the natives prefer to gather the wild product for they find it troublesome to cultivate a plant the seeds of which are gathered during a long period.

Experimental cultivation has given excellent results, quite equal to those obtained in the best producing countries.

*R. zanzibarensis*, on "sahel" soil has given a yield of 10 to 20 qx. per ha. according to the moisture of the soil, aspect of the ground and the quantity of manure given.

The oil made from these seeds is excellent; the writer consequently recommends the cultivation of the castor-oil plant on a large scale in the Protectorate of Morocco, as the oil is much in request in the French market.

F. C.

1302 - **Growth and Preparation of the Castor oil Plant, in Brazil.** — FIORIANO, A., in *Revista da Sociedade Rural Brasileira*, No. XXVI, additional loose sheet n. 3, Rio de Janeiro, Aug. 1912

During the war the cultivation of the castor-oil plant developed enormously in the State of São Paulo, it then decreased in importance owing to the rapid fall in prices and difficulties of preparation. At present the export demand has again increased considerably.

In 1920, from the port of Santos alone, 360 000 bags of castor-oil seed were exported and in 1921, 230 000 bags over and above the quantities prepared in Brazilian factories which have considerably increased their machinery. The present price (first half of 1922) is 460 *reis* per kg. of unhusked seed and 500 *reis* for machine husked seeds, or 25 *milreis* per bag of 50 kg. The exporting firms are constantly receiving large orders from Europe and America. Castor-oil seed seems therefore likely to become an article of large export and a source of wealth for the State of São Paulo. The writer quotes the case of a planter of Quariba who obtained 1500 bags of castor-oil seed from 29 ha. of land. The principal centres of cultivation are the district of Sorocobana and of the north-west of the State. Several manures containing a large proportion of castor-oil cake are on sale in São Paulo and are very suitable for manuring coffee. The writer recommends the extraction of the oil at the factory and the export of the oil, the cake from which would be a source of profit for the manufacturers.

F. D.

[1301-1302]

1303 - **Tanning Substances of Indo-China.** — HEIM, F. and CERCELET M., in *Bulletin de l'Agence générale des Colonies*, Year XIV, No 1617, pp. 10 7-1035, with fig.; Year XV, No 169, pp. 15-27, with fig. Melun, Dec 1921. Jan. 1922.

These papers deal with a preliminary series of investigations of certain barks sent to the General Laboratory of Colonial Products by the Indo-China Distiller's Company.

**GIÉ-QUANG BARK.** — Gié-Quang is, according to CHEVALIER the local name for *Quercus pseudocornea* A. Chev., which yields an excellent building timber and is common in the Tonkin forests, and more especially in the South-East (Tien-Yen); the natives call it "Gié-Quang" in Annam and "Gié-Quong" in Tho. The bark contains 15.92 % of tannin, which is very easily extracted and is excellent for tanning boot leather.

**GIÉ-MANGA BARK.** — This is from an unclassified species of *Quercus* and was collected at Na-Sa in Tonkin. The tannin content is 10.37 % but there is a large percentage of non-tannic substances among the soluble matter which renders this bark unsuitable for use in tanning.

**GIÉ-XANH OR GIÉ-SANH BARK.** — This comes from an unclassified species of *Quercus* and was collected at Pho-Vy. It contains 7.05 % of tannin; it would therefore be suitable for making extract and should be used mixed with the other tans for treating sole leather.

**SOI BARK.** — The botanical identification of this species is difficult as the name Soi is applicable to oaks and is also used for some *Castanopsis* and for *Sapium sebiferum* (*Euphorbiaceae*) but this species must be excluded since it is not indigenous in Tonkin and is only found near villages. Analysis shows 12.17 % of tannin almost exclusively pyrogalllic; its colouring power is very high; this bark would be suitable for making extracts and might be used if mixed with other tans for treating sole leather.

**SOI-DA BARK.** — This comes from an unknown species of oak, but the same name is given to a tree of the family *Styracaceae*, *Symplocos ferruginea* Roxb. = *Symplocos javanica* Kurz., common in the forests of the middle region. It contains 8.85 % of tannin with a large quantity of soluble non-tannin substances; the tannin is almost exclusively pyrogalllic. This bark is suitable for making extracts. In tanning it should be used mixed.

The article is illustrated by photographs and drawings of microscopic preparations which show the structures of the barks examined. F. C.

1304 - **Tanning Substances of Tonkin.** — TARDIVOT, F., in *Bulletin Economique de l'Indochine*, Year XXV (N S), No 152, pp. 28-34. Hanoi-Haiphong, Jan.-Febr. 1922.

The difficulties met with during the war, especially in 1918, in the importation of tanning substances into Tonkin have led to investigation of means of utilising the natural resources of the country in vegetable tanning substances. The investigation of these substances was made by means of the official method of powdered hide with chrome, the only method allowed by the International Association of Chemists of leather industries; in addition, some tanning tests were also made to ascertain any modifications of colour or quality caused by these tanning substances.

**MANGROVE BARKS.** — These have been supplied by Prof. CHEVALIER, Director of the Indo-China Scientific Institute, under the generic name

of Indo-China mangroves. But these barks, although they contain large percentages of tannins and similar substances, cannot be utilised because of their colour and the defects which they cause in the leather.

Dâng (*Rhizophora mucronata* Link) ; tanning substances 15.33 %.

Dirôe hồng (*Bruguiera gymnorhiza* Lour.) ; tanning substances 15.64 %.

Dirôe trắng (*B. gymnorhiza* Lour. var.) ; tanning substances 20.24 %.

Chang vet (*Kandelia rheedii* W. and A.) ; tanning substances 21.83 %.

Dong dinh (?) , tanning substances 28.78 %.

GIÉ BARKS. — The natives call the Cupuliferae by the name gié, especially those belonging to the genera *Quercus* and *Castanopsis*.

Three samples from the Province of Thái-Nguyên yielded 9.67 % — 5.50 % — 6.50 % of tannins respectively.

Three samples from the Phuto district yielded :— Gié-trắng 4.28 % — Gié tia 3.36 % — Gié cháng 4.72 % of tannins.

Three samples from the Bac-giang district yielded :— Soi (*Quercus* sp.) 7.36 % — Soi cau (*Castanopsis* sp) 8.24 % — Soi phang (*Quercus* sp.) 9.04 % of tannins.

#### MISCELLANEOUS BARKS :—

Nghien ( <i>Nephelium</i> sp ?) .	1.73 % of tannins
Vai ( <i>Nephelium Litchi</i> Camb )	1.2       "       "
<i>Quercus</i> sp. ? . . .	6.8       "       "
Céo ( <i>En elhardia</i> )	7.6       "       "
Mirong ( <i>Cassia</i> ?)	11.4       "       "

FLOWERS AND FRUIT OF CÂY BANG (*Terminalia Catappa* L.). — Contain a fairly large percentage of tanning substances :—

Dry leaves	8.94 %
Dry fruit . . . . .	9 %

but tanning tests have not given satisfactory results.

#### WOODS :—

Soi phang ( <i>Quercus</i> )	1.2 % of tannins
Lum ( <i>Erythrophlaeum Fordii</i> Oliv)	5.88       "       "
Idem . . . . .	4.10       "       "

The leaves of Cây voi (*Eugenia operculata* Roxb.) are not utilisable for tanning.

CUPULES OF THE ACORNS OF MA-LI-CHOU (*Quercus* sp.). — These come from Yunnan and are similar to cupules of the Valonia oak ; they contain 20 % of tannins.

The writer concludes that it would be inexpedient, under present conditions, to exploit Indo-China resources of crude tanning substances unless very large plantations of mangroves are made and he raises the question whether in the future tanning will be done with vegetable tans, with synthetic tannin or with mineral salts.

F. C.

[1894]

**RUBBER GUM  
AND  
RUBBER PLANTS**

1305 - **Cultivation of the Soil in Rubber Plantations.** — MAAS J. G. I. A. and RUT. RUTGERS, A. A. L., in *Medeelingen van het Algemeen Proefstation der A. V. R. O. S., Rubberserie*, No 36, Year VI, No 7, pp 214 Buitenzorg, July 1922

One of the writers, MAAS, explains some theories relating to the effects of tillage on the soil ; these theories tend to prove the superiority of green manure to weeding. He then gives the results of some experiments made on 12 plots of land 1.6 ha. in area, planted with *Hevea*, situated in the State of Tandjong Merah ; these results are summarised in the following Table.

Period	Difference between the average yield of untilled land and land manured with green manure
Before weeding (1st Dec 1916 - 1st Feb 1917)	00% $\pm$ 25
First period after weeding (1st May 1918 - 1st Nov 1918)	+ 10% $\pm$ 32
Second period after weeding (10 July - 25 Oct. 1919)	+ 50% $\pm$ 36
Third period after weeding (1st Apr 1921 - 1st Apr. 1922)	— 9 (approximate calculation)

These experiments prove that weeding does not have any beneficial effect.

RUTGERS next gives the results obtained in two estates in which weeding began to be done in 1917, and which gave an increased yield of over 100 % , this led to the system being introduced into several other estates. A critical examination of the monthly production in the first two estates, compared with that of three neighbouring estates, showed that the increased production took place not only in the two estates in which weeding had been usually done but also in the three others in which the ground remained constantly under weeds. Moreover, in the same estate, there had been a parallel increase in sections in which weeding was finished in August and in those where it was commenced in August.

In conclusion, there is nothing to show that the increased yield was due to weeding.

A. d. B.

1306 - **The Root System of Hevea in various Soils.** — GRANTHAM, J and BISHOP, O. G., in *Archief voor de Rubbercultuur in Nederlandsch-Indië*, Year VI, No 7, pp 231-247, 16 figs Buitenzorg, July 1922

The writers have examined the development of the root system of *Hevea* in various soils and have arrived at the following conclusions :—

1) The root system of *Hevea* varies very much according to different soils. The height of the water table is the main factor of the limitation



of development of the roots. Mechanical resistance is a limiting factor in compact soils.

2) There is a general correlation between above-ground and under-ground development. Trees planted in sandy soil, with an extensive root system and poor development above-ground, are exceptions.

3) There is no correlation between good individual development of the roots and high production on the best types of soil, but only a certain relation on the poorest soils. The best soils, with the most extensive root system, give the best yield.

4) The typical appearance of the root system becomes apparent in youth (3 to 3 ½ years), but is less marked later. Differences in root systems in different soils at that age are greater than those in the foliage of the different trees.

5) As the lowering of the water table is of great importance it is very desirable to carry this out whenever practicable.

6) Although the breaking up of compact soils by means of explosives causes the mechanical resistance to decrease and may lead to the assumption that it is advantageous, experiments made gave negative results.

7) Soil improvements while the plants are young is recommended.

8) Root interference should be considered in connection with the question of thinning. In the case of the greatest root development observed the roots of a tree were interlaced with those of 58 other trees.

9) The root development just mentioned shows the possibility of a tree with diseased roots infecting a large number of other trees.

F. C.

1307 - **Practical Examination of the Bark of Hevea and its Importance in Tapping.** —

VIEIL, G., in *Bulletin de l'Association des Planteurs de caoutchouc et autres produits coloniaux*, Vol IX, No 6 and 7, pp 119-122. Antwerp, June July 1922

When in 1918 Dr. ROBILLIOT drew the attention of planters to the possibility of distinguishing good and bad rubber yielding trees by a simple examination of the structure of the bark, attempts were made to apply this method practically, but most of those interested continued to adhere to the old method by testing the latex produced by each tree.

Nevertheless the selection of good rubber producing trees is very important in young plantations in which thinnings have to be made; it is a mistake to go by the standard of the most vigorous tree, for it is not always the most vigorous tree which produces most rubber. On the other hand the standard of yield for the selection of trees to be left cannot be applied to very young plantations.

In such a case simple examination of the bark may give useful results, for it is known that there is a close connection between production and the number of layers of laticiferous vessels.

In using this method the following procedure should be adopted :— the trees in the plantation to be examined are serially numbered; a gang of three coolies then removes samples of the bark at a height of 50 cm.

from the ground working as follows :— the first coolie measures the girth of the tree at the given height and removes two small round pieces of bark about 7 mm. in diameter from the two opposite sides of the tree, with a special knife. The second coolie writes the serial numbers of the plantation and of the tree and its girth on a small paper label. The third coolie takes the bark samples and the label and wraps them up in a coffee or Hevea leaf which he ties with banana fibre thus making a small packet.

Working in this manner a gang of three coolies can collect samples from 400 trees in a day. During the two following days two other men examine the laticiferous vessels using the following articles for that purpose :—

- 1) One hundred numbered glassplates, size 10 cm.  $\times$  3 cm.
- 2) A very sharp pruning knife.
- 3) A magnifying glass (magnifying 10 to 12 times).
- 4) Strips of paper on which to paste about ten labels.
- 5) Strong nitric acid saturated with chlorate of potassium.
- 6) Tincture of iodine.

The procedure is as follows :— each coolie takes a glass plate noting its number on a strip of paper ; he opens a packet containing bark (which should be from the previous day's collection) ; he cuts a thin horizontal section of the bark, 1 mm. thick ; he moistens the sections with a drop of nitric acid containing chlorate of potassium which makes them transparent and makes other sections of the same bark placing them on the same glass plate.

These sections are treated with tincture of iodine which stains the laticiferous vessels dark brown ; one of the men can thus count them with the help of the magnifying glass while the other enters the number on the label corresponding with the glass plate.

The writer thinks that, in the case of trees 3-5 years old, it is better to count all the laticiferous vessels visible without differentiating between those of the internal and external layers. This work should be checked occasionally by a European to see that it is correctly done.

With this system, the trees can be divided into 3 classes :— those which have more than 6 layers of laticiferous vessels, marked with a green ring ; those which have 6 layers, marked with a yellow ring and those which have less than 6 layers, marked with a red ring. Trees with diameters over 40 cm. at 50 cm. from the ground are tapped and three men with buckets of the same colour as the rings which distinguish each class of tree look after the collection of the latex. A quantitative determination of the rubber contained in equal quantities of latex taken from the three classes of trees is then made daily. Tapping is continued for several weeks so as to obtain a proper average.

It appears from tests made by the writer according to this method that the trees richest in laticiferous vessels (that is to say those marked with green rings) were the best rubber producers : their yield was almost double that of the trees marked with red rings.

As trees poor in laticiferous vessels should be eliminated after a

longer or shorter period, it would be well to tap them as low as possible to get from them the maximum yield of rubber.

As the trees in a plantation grow and become full sized, the necessity for thinning becomes apparent and the trees which are poorest in laticiferous vessels should be felled first.

In the absence of a better method, the writer, from his experiments, considers that the examination of the bark is a satisfactory way to distinguish good producers from moderate or bad ones and to make scientific thinnings in rubber plantations.

F. C.

1308 - Individual Variations in the Starch Content of the Bark of *Hevea brasiliensis*. — SCHWEIZER, J., in *Archief voor de Rubbercultuur in Nederlandsch-Indië*, Year VI, No. 6, pp. 209-219. Buitenzorg, June 1922.

The writer for two years investigated the variations in the starch content of *Hevea* bark, during the winter period. The results varied in different trees. Contrary to the known phenomena for trees of the temperate zone, in which the starch, after wintering, is utilised first of all by the branches and moves gradually towards the trunk, the writer distinguished three different cases in the matter of the utilisation of the starch in *Hevea* bark.

1) There are trees which dissolve first of all the starch contained in the bark of the upper roots while they form their leaves and which do not utilise until later the starch in the upper parts of the trunk.

2) The movement of the starch may take place simultaneously in the bark of the roots and that of the trunk.

3) The dissolution of the starch commences first of all in the branches and in the bark of the upper part of the trunk and continues downwards towards the roots.

The writer cannot be certain which of them is the normal case. Very probably the case in which the dissolution of the starch commences near the top of the trunk is more frequent than the others.

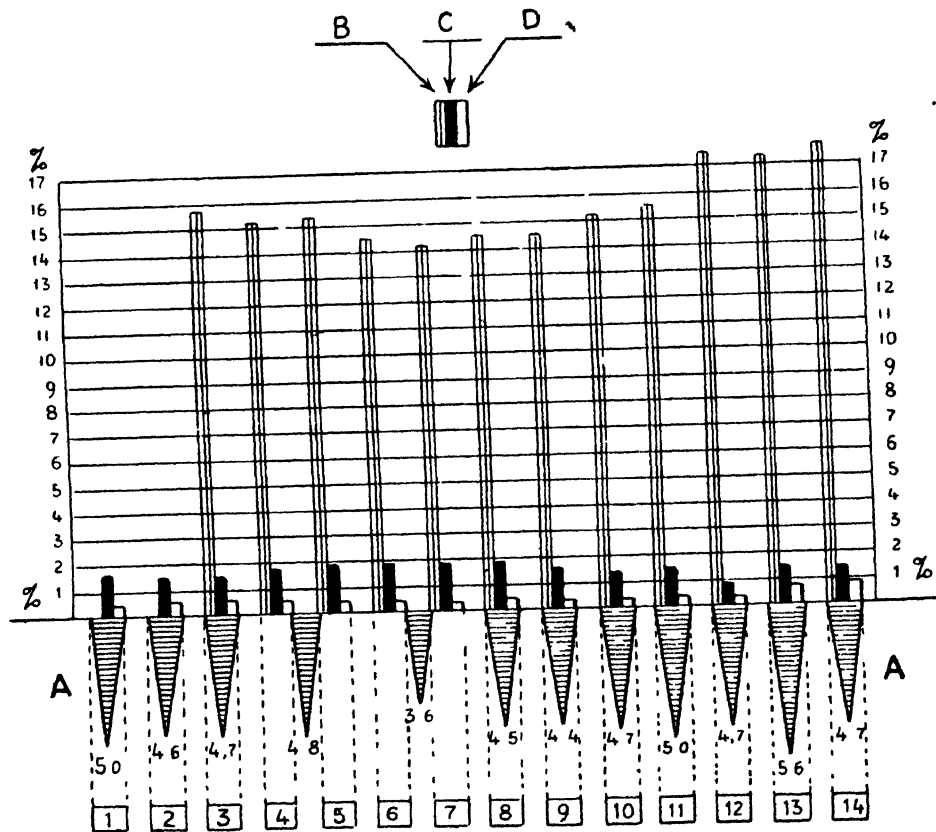
Individual variations in the starch content of *Hevea* appear in the renewal of the bark and in the incision. If a tree is tapped in such a way that the draining of the latex is prevented there is only a consumption of bark. In certain cases the disappearance of the starch may take place over a large surface; in other cases the starch remains intact. Trees in which tapping is normal show similar differences. Trees which produce most, consume less starch. This is not in agreement with the general opinion, held among others by BOBILIOFF, namely that there is a direct connection between the dissolution of starch in intensive tapping and the formation of rubber. In researches relating to this point the influence of renewal of the bark should be taken into consideration. Other factors, for example the stimulus of the wound, have a certain influence on the dissolution of the starch.

F. C.

1309 - On the Presence of Quebrachite and Sugar in the Latex of *Hevea*, according to different Circumstances. — SPOON, W., in *Archief voor de Rubbercultuur in Nederlandsch-Indië*, Year VI, No 7, pp 269 287 Buitenzorg, July 1922

Substances having rotatory power and a sugary taste have been found in *Hevea* latex. The principal substance is a mono-methylinosite and

*Composition of latex at various times of the year.*



EXPLANATORY NOTE:

- A = yield of rubber per tree per day; B = ash in dry matter; C = quebrachite in the serum  
1 to 14, see periods in Table I, p 1507

the others belong to the sugars. Data regarding these substances were often rather vague: the methods of determination and the calculation of their percentages were not always described very clearly. Some data regarding quebrachite were furnished by PICKLES and WHITFIELD who found 0.46 %, while GORTER estimated the percentage at 1.45 %.

TABLE I — Results obtained at the Experimental Gardens at Buitenzorg by tapping daily  
a certain number of *Hevea* trees on  $\frac{1}{4}$  of their girth.

Period	Latex		Grammes of rubber per tree per day	Serum + acetic acid									
	Cubic cm. per tree per day	S. G.	Percent- age of rubber	S. G.	Dry matter %	Ash %	$\frac{0.1}{100}$ of ash in the dry matter	$\alpha$	$\beta$	$\gamma$	$\gamma-\alpha$	Quebrachite %	Sugar %
April 1919 . . . . .	15	0.9826	32.6	—	—	—	—	2°26'	3°2'	—	—	1.79	0.33
May . . . . .	14	0.9820	33.6	—	—	—	—	2°3'	2°53'	—	—	1.67	0.45
June . . . . .	14	0.9813	34.3	1.01915	4.31	0.68	15.8	1°59'	2°52'	—	—	1.65	0.48
July, 1st half . . . . .	—	0.9813	—	1.0204	4.64	0.70	15.1	2°22'	3°9'	—	—	1.84	0.43
„ 2nd „ . . . . .	14	0.9818	34.5	1.02085	4.66	0.71	15.2	2°46'	3°7'	—	—	1.88	0.19
August, 1st half . . . . .	—	0.9834	—	1.0209	4.68	0.68	14.5	2°32'	3°14'	2°57'	25'	1.90	0.38
„ 2nd „ . . . . .	11	0.9839	33.0	1.0193	4.545	0.64	14.1	2°43'	3°11'	3°5'	22'	1.90	0.25
September . . . . .	14	0.9839	32.0	1.0187	4.30	0.63	14.6	2°36'	3°14'	2°54'	18'	1.91	0.35
October . . . . .	13	0.9834	32.4	1.0187	4.30	0.63	14.6	2°32'	2°48'	2°46'	14'	1.69	0.15
November . . . . .	15	0.9839	32.0	1.0173	3.98	0.60	15.1	1°54'	2°11'	2°8'	14'	1.31	0.15
December . . . . .	16	0.9846	31.5	1.0173	3.87	0.60	15.5	1°52'	2°11'	2°4'	12'	1.31	0.17
January 1920 . . . . .	15	0.9848	31.3	1.0169	3.69	0.64	17.4	1°24'	1°39'	1°43'	19'	0.99	0.14
February . . . . .	17	0.9839	31.9	1.0174	3.815	0.66	17.3	1°46'	2°30'	2°4'	18'	1.44	0.40
March . . . . .	15	0.9841	31.8	1.0175	3.89	0.68	17.5	1°29'	2°18'	1°43'	14'	1.31	0.45

CAMPBELL, who found that natural coagulation of latex depends on an enzyme, remarks that several enzymes are compounds of protein and carbohydrates and that in this case it is possible that the monomethylinosite may form the greater part of the enzyme in *Hevea* latex.

On account of the different methods employed, it is difficult to find in the literature on the subject the exact figure for the quantity of sugar.

PARKIN who said that this sugar appeared in every respect similar to saccharose, estimates the quantity at 0.3-0.7 %.

BEADLE and STEVENS found 0.34 % and 0.79 % of sugar (calculated in the rubber as glucose) in two samples of *Hevea* latex. GORTER gives 0.25 % as the figure for the sugar ; GROENEWEGE was able to make sure of the presence of fermentable sugar in the latex. He calculated a glucose content of 0.9 gm. per litre of serum.

The writer in making experiments regarding the quantities of quebrachite and sugar present in *Hevea* latex was mainly concerned about finding a good method of determination, as methods previously described in the literature on the subject were wanting in precision. The ordinary method for the estimation of sugars by reduction of Fehling's solution could not give exact results in this case for the reaction was complicated by the presence of other constituents of the latex (probably proteins). Another well known method for the estimation of sugar is the determination of the rotatory power.

There are three distinct groups of substances in the latex which deflect rays of polarized light, namely quebrachite, glucose and protein. VERNET thinks that the polarimeter cannot be used on account of the proteins ; they must therefore be first eliminated. The specific rotatory power of quebrachite is known ; the identity of the sugar has not been recognised properly, so that the figure indicating its specific rotatory power cannot be obtained ; the same is true for the proteins. Apparently therefore there are sufficient reasons for supposing that there is saccharose, the specific rotatory power of which is known, in the latex ; on this hypothesis the use of the polarimeter becomes possible. The writer describes the method which he used for the investigation and estimation of these substances in the latex and he explains the formulae which he used for determining the specific rotatory power. His results are given in Tables I and II.

The daily quantity of latex per tree is almost constant from May to November, but the quantity of rubber is very irregular. Towards the end of the experiments, mineral substances tended to increase, while there was a marked decrease in quebrachite.

The greatest differences were found in January and February 1920, when the seed was falling.

Other experiments were made with another group of trees divided into 2 lots which were first tapped simultaneously (see Table II) ; then lot A was tapped daily by a  $\frac{1}{2}$  circumference incision (see Table III), while lot B was tapped every other day (see Table IV).

In group B of trees first tapped daily as control trees and afterwards

TABLE II — *Groups of trees A + B.*

Period	Cubic cm of latex per tree per day	Percentage of rubber in the latex	Grammes of rubber per tree per day	Serum + acetic acid					
				$\alpha$	$\beta$	$\gamma$	$\gamma-\alpha$	Quebrachite %	Sugar %
6/4/20-19/4	15	48.9	7.5	1°20'	2°20'	—	—	1.30	0.55
12/4 -17/4	35	41.7	14.7	1°45'	2°27'	2°5'	20'	1.42	0.38
19/4 -24/4	42	36.2	15.1	1°54'	2°10'	2°20'	26'	1.30	0.15
26/4 - 1/5	42	31.8	13.4	2°5'	2°23'	2°21'	16'	1.43	0.16
3/5 - 8/5	39	29.1	11.4	2°6'	2°22'	2°30'	24'	1.43	0.15
10/5 -13/5/20	40	29.0	11.4	—	—	—	—	—	—

TABLE III — *Trees of group B, tapped daily*

Period	Cubic cm of latex per tree per day	Percentage of rubber in the latex	Grammes of rubber per tree per day	Serum + acetic acid								
				Dry matter	Ash	% of Ash in the dry matter	$\alpha$	$\beta$	$\gamma$	$\gamma-\alpha$	Quebrachite %o	Sugar %
14/5/20—22/5	32	29.0	9.4	3.96	0.65	16.4	2°26'	2°49'	2°42'	16'	1.69	0.21
24/5 —29/5	29	28.7	8.4	4.15	0.66	15.9	2°40'	2°59'	2°44'	4'	1.80	0.17
31/5 — 5/6	28	28.5	8.0	4.09	0.67	16.4	2°31'	2°45'	2°39'	8'	1.67	0.13
7/6 —12/6	23	28.5	6.6	4.09	0.68	16.6	2°28'	2°48'	2°32'	14'	1.69	0.18
14/6 —19/6	22	29.5	6.5	4.16	0.69	16.6	2°27'	2°49'	2°35'	8'	1.69	0.20
21/6 —26/6	23	31.6	7.3	4.18	0.65	15.6	2°6'	2°35'	2°19'	13'	1.53	0.26
28/6 — 1/7/20	23	31.6	7.2	4.08	0.67	16.4	2°5'	2°27'	2°22'	17'	1.47	0.20

TABLE IV — *Trees of group B*

Period	Cubic cm of latex per tree per day	Percentage of rubber in the latex	Grammes of rubber per tree per day	Dry matter	Ash %	Ash in the dry matter	Serum + acetic acid					
							$\alpha$	$\beta$	$\gamma$	$\gamma-\alpha$	Quebrachite %	Sugar %
Tapped daily												
14/5/20-22/5 . .	51	26.8	13.7	3.79	0.65	17.2	2°15'	2°28'	2°35'	20'	1.50	0.12
24/5 -29/5 . .	45	26.5	11.9	3.92	0.68	17.3	2°20'	2°36'	2°29'	9'	1.57	0.15
31/5 - 5/6 . .	40	26.7	10.7	3.94	0.69	17.5	2°12'	2°35'	2°18'	6'	1.54	0.21
Tapped every other day												
7/6 -12/6 . .	35	28.2	9.9	4.00	0.68	17.0	2°14'	2°34'	2°20'	6'	1.54	0.18
14/6 -19/6 . .	37	30.3	11.1	4.12	0.69	16.7	2°2'	2°36'	2°10'	8'	1.53	0.31
21/6 -25/6 . .	33	32.5	10.7	4.16	0.68	16.4	1°50'	2°24'	2°5'	15'	1.40	0.31
28/6 - 1/7/20.	34	34.0	11.6	4.16	0.69	16.6	1°40'	2°26'	2°1'	21'	1.40	0.42

every other day, an increased rubber content was noticed, corresponding with an increase of sugar, while the content of mineral substances decreased. The yield of latex decreased by 40 % per tree during the first month following the change in the method of tapping. Other experiments have shown that production increased gradually in the following months. However the experiment was too short to allow of new and definite conclusions being drawn.

F. C.

1310 — **A Note on the Sugar in Hevea Latex.** — VAN DILLEN, L. R., in *Archief voor de Rubbercultuur in Nederlandsch-Indië*, pp 263-268 Buitenzorg, July 1922

A few writers have given figures regarding the quantity of sugar found in Hevea latex, but very little is known regarding its determination. This sugar has never been identified.

The writer made an investigation of the dialysed part of latex ; it was only after inversion that he was able to determine the sugars by their reducing action on Fehling's solution.

The inverted dialysed portion was treated with sulphite of phenylhydrazine ; it was thus possible to isolate the glucosazone and the galactosazone.

Latex perhaps contains some ethersaccharides, which give as decomposition products either glucose or fructose, or both sugars simultaneously, and galactose.

The writer does not consider it likely that saccharose is found in latex

F. C.

#### SUGAR CROPS

1311 — **Palm Sugar in Cambodia.** — CARDOT, J., in *Revue d'Histoire Naturelle appliquée*, 1st part, Vol III, No 6, pp 182-186 Paris, June 1922

In Cambodia, in addition to the manufacture of cane sugar, an industry which is very extensive in the countries of the Indo Chinese Union, there is a small local industry which makes use of the sap of a palm (*Borassus flabelliformis*) which is widely disseminated in the district. This palm may attain a height of over 20 m. and has a crown of leaves in the form of a fan, to which it owes its specific name ; this palm is dioecious, and if an incision be made at the right time in the stamiferous and especially, in the pistiliferous inflorescences it yields a sweet sap which is collected in special bamboo receptacles from 10 to 15 cm. in diameter and from 25 to 30 cm. long, these receptacles are called " ampong " and are changed twice a day, care being taken to revive the incision. Generally, two inflorescences only are treated at the same time on each tree, all the flowers being first nipped off by means of wooden pincers. The harvest begins in November or December and continues till April or May. CASSIER estimates the average daily yield of each tree at 3 litres during the first 3 months, and half this quantity during the following 3, bringing the total production to about 40 000 litres. CREVOST and LEMARIÉ consider that 6 to 7 litres of liquid are required to produce 1 kg. of sugar ; each tree therefore would yield about 60 kg. of sugar. But the production of the different trees varies greatly, and it often happens that, for some unknown



reason, some trees produce scarcely any sugar, and these are then abandoned after a 3-years trial.

The task of collecting is very dangerous, because the men have to climb to a great height on very light ladders made of bamboo stems.

The *Borassus* is of very slow growth: the tree cannot be utilised until after 20 or 30 years and its productive period lasts about 20 years.

The sweet liquid may be drunk when fresh, but it soon becomes acid; by fermentation and the addition of pepper, cardamom and ginger, a palm wine is made which is much appreciated by the natives.

The sugar is manufactured by first placing in the "ampong" a piece of Pepel or Doeum pepel (*Shorea cochinchinensis*), a tree of the Dipterocarp family, which is said to prevent or delay fermentation. The liquid is then filtered, boiled in an earthenware pot and reduced to half its volume; the semi-liquid substance thus obtained is poured into moulds formed of strips of *Borassus* leaves rolled into a circle and arranged on a board. After some time, the cakes become completely solidified and are of various sizes; they weigh from 23 to 200 gm. each. In March towards the end of the season, the crystallisable sugar forms almost immediately into glucose, and then molasses only can be obtained, which is sold in earthenware jars. The molasses is in strong request by the Chinese distillers, who make a kind of alcohol from it which they mix with arrack.

An analysis of the sugar made by BERTRAND gave the following results:

Water (moisture) . . . . .	2.6 %
Saccharose (ordinary crystallized sugar) . . . . .	89.2
Inverted sugar . . . . .	4.2
Various organic matters . . . . .	2.3
Ash . . . . .	1.6

Distilling tests have given 51 litres of alcohol per 100 kg. of sugar

Considerable quantities of this sugar are produced because, over and above that required for local consumption, a certain quantity remains for exportation. The Commercial Agricultural Departments of Cambodia have recently reported to the Economic Agency of Indo-China that there is an annual available quantity of 10,000 qx. of sugar loaves and 12 000-15 000 qx. of molasses.

The sugar is excellent, of an agreeable flavour and may be employed in making confectionery.

F. C.

1312 — **The Cultivation of Tobacco in the Crimea.** — *Economiceskaja Sizu*, no 225. Moscow, 1922.

According to investigations made, thanks to the initiative of the tobacco Syndicate, on 500 farms where tobacco is grown in the Crimea, the situation of the growth of that plant in that area is shewn in the annexed table (p. 1512)

In the last few years tobacco plantations have been given up in favour of cereals, or converted to grass or left entirely uncultivated. Live and dead stock are very much reduced. On 50 % of the properties which were inspected no greenhouses, glass or frames exist; in 40 % they are in an abandoned condition; only 10 % have maintained their greenhouses. I. G.

STIMULANT,  
AROMATIC,  
NARCOTIC  
AND  
MEDICINAL  
PLANTS

Years	Number of plantations	Area in <i>décistines</i>	Yield in <i>pounds</i>
1911	7200	3400	260000
1914	5200	2800	220000
1917	5600	3200	200000
1919	4000	2100	120000
1920	3200	1500	150000
1921	—	530	10000
1922	—	200	—

1 *décistine* = 1.0925 ha. — 1 *pound* = 16.38 kg.

1313 — **Nicotine Content of South African Tobacco.** — JURITZ Chas F (Chief Division of Chemistry), in *The South African Journal of Industry*, Vol V, No 8, pp 347-366, bibliography of 6 publications Pretoria, Aug 1922

In consequence of a proposal to start a factory for tobacco extracts in the Transvaal, the writer was instructed by the Minister of Agriculture to make estimations as to the nicotine content of various species of South African tobacco ; he obtained the following results .—

1) The heavy South African tobacco, grown at Barberton, Piet Retief and Potchefstroom, contain in their air dried leaves, from 3 to 5 % of nicotine

2) The nicotine content of the leaves of light tobacco does not generally exceed 2 % and often does not even reach 1 %

3) The leaves of the common wild tobacco (*Nicotiana glauca*) contain, according to the few analyses made, decidedly less than 1 % of nicotine

4) *Nicotiana rustica* gives the best results, its leaves contain 6 to 8 %, or even more, nicotine ; this alkaloid is more abundant in the leaves, but all parts of the plant, stalks, flowers and roots, also contain it

If it is permissible to draw any general conclusions from a single series of experiments, it appears that in young transplants the leaves contain a small percentage of nicotine, generally less than 1 % ; this percentage increases rapidly up to 2 % six weeks after transplanting ; it approaches 3 % two months later and reaches 6-8 % when the plant is fully mature.

A. de B.

#### HORTICULTURE

1314 — **Notes on the Cultivation of the Pineapple** (1) — KOPP, A, in *Revue de Botanique appliquée et Agriculture coloniale*, 2nd Year, No 13, pp 483-509 Paris, Sept 1922

A general article on our present knowledge of *Ananassa sativa* L, in which the writer has considered the different works published on the subject for the last twenty years.

(1) See also : - R March 1911, No 849, R April 1913, No 440 ; R Aug. 1914, No 798, R Oct 1914, No 967 ; R Jan 1917, Nos 106 and 114 ; R June 1917, No 607, R Dec 1917, No 1239 ; R Feb 1918, No 243 ; R Sept 1918, No 995 ; R Oct. 1918, No. 1125 ; R Nov-Dec 1920, No 1119, R July 1922, No. 790 (Ed.)

That cultivation has considerable interest, for it extends to nearly all tropical countries.

The principal varieties relating to each country are enumerated and described. The writer examines particularly the natural conditions required for the growth of pineapples and especially the question of manures, a question on which different writers do not agree, particularly as regards the season and the relative importance of various phosphate manures.

Systems of planting, reproduction and cultural operations form the subject of a long careful examination. Methods of despatch, packing, and preserving are passed in review in the various countries.

The pineapple as a source of fibre is also noted; on this subject cultural peculiarities relating to pineapples grown for fibre are mentioned, particularly as regards the spacing, which should be closer than in the case of pineapples grown for fruit.

The most important chapter is that which deals with pests and diseases of the pineapple.

**PHYSIOLOGICAL DISEASES.** — These are no doubt due to the physiological conditions of the soil. "Spike" or "Long leaf" is a deformation of the leaves. Plants affected seldom produce fruit. This disease is attributed to the chemical composition of the soil. Writers are not agreed as to the cause. It is thought that the disease is hereditary; 80 % of the plants produced by diseased pineapples are affected by "Spike". It is recommended to destroy the diseased plants or not to use plants raised from them for planting. "Tangelroot" or entanglement of the roots is without doubt due to the physical condition of the soil.

"Chlorosis" shows itself by a discolouration and by the vegetative system turning more or less yellow. Spots first appear on the leaves. This is due to disappearance of the chlorophyll. This disease is prevalent in badly drained over-calcareous soils. The iron content of the plant becomes greatly reduced; consequently, washing the leaves with sulphate of iron is recommended. It has been noticed that, of calcic compounds, only carbonate of lime is injurious; a large amount of organic matter removes this effect, also a strong alkalinity of the soil (carbonate of soda). By growing in the shade, the destruction of the chlorophyll is delayed, which mitigates the disease. It should be noted that chlorosis may appear as a consequence of bacterial disease.

**FUNGOID DISEASES** — These are the following. — "Blight" or "wilt" (wilting), caused by a *Fusarium*. It is controlled by pulling up the affected plants; before replanting care is taken to disinfect the soil with quick-lime or sulphate of copper.

"Black heart" or "bitter heart"; the fruit becomes watery; the causes of this disease are obscure and no effective remedies are known.

"Leaf Spot" or brown spots on the leaves; this disease seems to be connected with weather conditions.

"Core-root" or decay of the eyes of the fruit; it is thought that this disease is due to *Monilia candida*.

Among fungi attacking the fruit may be mentioned:— *Chalara*

*paradoxa* (*Thielaviopsis paradoxa*) which affects the colour and texture of the fruit.

INJURIOUS INSECTS. — Most of them are Hemipteræ, Diaspidæ or Coccidæ:— *Diaspis bromeliæ* (Hawai), *Aspidiotus bromeliæ* (Azores or Canaries), *Dactylopius* or *Pseudococcus bromeliæ* (America, Hawai, South Africa, Uganda), *D. longispina* (New Guinea, Queensland), *D.* or *P. citri*.

*Pseudococcus bromeliæ* has parasites:— *Diadiplosis pseudococci* Felt., *Blephyrus tachygalia* Brues., *Coccidiotrophus socialis* Schwatz and Baker, *Eumausibius wheeleri* S. and B., *Pinnaaspis buxi* and *Chrysomphalus bifrons* attack *Bromelia Pinguin* at Porto Rico. *Solenopsis geminata* has also been found. In Northern Australia white ants are very injurious to pineapples.

Among the Coleopteræ are mentioned *Metamasius ritchici*, *M. sericeus* and *Cholus wattsi*. Among Hymenoptera, the larvæ of *Hypolycaena philippus* attacks the fruit.

Thrips and Mites, as well as *Stigmaeus floridanus*, also attack pineapples.

Lastly it should be noted that porcupines are particularly fond of pine apples. P. C.

#### FRUIT GROWING

1315 - Cherry Growing in Wisconsin, U. S. — ROBERTS R. H., in *Agricultural Experiment Station of the University of Wisconsin*, Bulletin 344, 30 pp., 29 fig. Madison, June 1922

The Bulletin reviewed gives arboriculturists rules based largely on results of scientific research.

GROWTH. — The growth of the tree and the crop being two correlated facts, cultural methods should be based on the development of the tree which should be brought to the stage in which a large number of fruit buds are formed. To obtain abundant crops it is generally necessary that most of the terminal and principal side branches should increase each year by 35 to 45 cm.

MANURES. — Very productive orchards are generally manured. Farmyard manure applied to cherry trees gives good results; if none is available it may be replaced by chemical manures.

It does not appear that phosphate or potash manures are very beneficial (at least in the conditions in the Sturgeon Bay district where the experiments were made); they are, however, often necessary for the undergrowth (which serves as green manure). Nitrogen in quickly assimilable form (nitrates or sulphate of ammonia) has given very good results in several cherry orchards; these manures are generally given to the extent of 1.5 kg. per tree, two or three weeks before the trees begin to flower. Nitrogenous manures retard considerably the date of ripening, especially in the case of trees with thick foliage; this delay is not prevented by the use of other fertilizers; it appears therefore to be inevitable in cherry orchards in which sustained heavy production is desired.

CULTIVATIONS. — Tilling the soil should be continued even after the crop is picked so that the tree may not stop ripening its wood too quickly,

for, if this process is prolonged, larger fruit and consequently a better crop will be obtained. In 1920, when scanty rainfall rendered cultivation more effective, cherry trees in orchards, which were well tilled produced, in the following year, fruit 18 % larger in the case of the Richmond variety and 19.5 % larger in the case of the Montmorency variety, than fruit produced by cherry trees under identical conditions except that tillage had ceased at an early date.

**PRUNING.** — This is essential if manuring and tillage is to give an abundant crop. It is recommended that the tree should not be allowed to grow tall, to top it early, to arrange that the main branches are as even sized as possible, by pruning more drastically those which tend to become largest. Trees which produce badly generally remain poor yielders indefinitely ; it is therefore well to improve them by drastic pruning.

In 1919 an experiment was started in Door County (Wisconsin) to ascertain the amount of pruning which would be effective and at the same time would not diminish the crops of the early years. A comparison was made between light and heavy pruning on the two principal varieties grown :— Early Richmond and Montmorency (eight year old trees planted 6 m. apart in squares) and it was noticed that, compared with unpruned trees, both light annual pruning and heavy pruning followed by periodical light trimmings, diminished, indeed, the "fruiting area" (number of flower buds per tree), but increased the yield, for a larger percentage of the remaining buds produced ripe fruit. The unpruned trees in all cases suffered a heavy fall of immature fruit. The control trees (unpruned), the trees pruned heavily and those lightly pruned yielded on the average, respectively :— Early Richmond 15.3 l. — 18.7 l. — 20.8 l. of cherries per tree ; Montmorency 39.7 l. — 49.3 l. — 42 l. per tree.

**INDIVIDUAL VARIATIONS.** — The productiveness of trees depends on their growth rather than on the treatment applied to them. Cherry trees that produce badly remain bad producers, compared with heavy cropping trees whether pruned or manured or both together. Apparently, there is close correlation between the type of flower buds and productiveness ; trees with a high percentage of spurs are good producers ; the varieties which have the best system of spurs are more productive than those whose system of spurs is bad, particularly in year following a cold winter. This was the case, for instance, with the Montmorency variety, in 1920-21 (a year with a cold winter) there were counted :— 1) *Richmond variety*, on 4 trees respectively 8860 — 9913 — 11 832 — 12 218 flower buds, percentage of flower buds borne by spurs 36.8 — 45.3 — 38.7 — 54.3 ; yield of cherries per tree 27 — 29 — 33 — 44 litres ; 2) *Montmorency variety* on 4 trees respectively 10 304 — 11 283 — 13 303 — 15 550 flower buds ; percentage of flower buds borne by spurs 31.2 — 38.8 — 53.8 — 59.0 ; yield 33 — 33 — 41 — 47 litres of cherries per tree.

Observations have shown that there is close correlation between the number of flower buds killed by frost in winter and the growth of the tree.

The buds which are in the most advanced stage of development at the beginning of winter are more liable to be killed by frost. Generally the

pre-winter development of flower buds is more noticeable on trees of slower growth. It is therefore not good to stop the early ripening of the wood for though in such cases resistant branches are formed it is nevertheless true that this advantage is to a great extent counteracted by the fact that these branches bear flower buds which stand cold badly. It is therefore better to run the risk of the death of the young branches, much less likely, in Wisconsin conditions, in the case of branches which in a good season have not grown longer than 60 cm.

The flower buds borne on the spurs are more resistant to frost than those which are borne on the sides of long branches. During the winters from 1918 to 1920 frost damaged:— *a) Richmond variety*:— lateral buds 80.9 — buds on spurs 40.8 — average number of flower per bud; — lateral 1.76, on spurs 2.39 — flowers per 100 buds:— lateral 33.6; on spurs 141.4 — *b) Montmorency variety*, respectively 65.6 and 26.1 — 1.79 and 2.24 — 61.5 and 165.4. These results explain why trees which have most spurs yield the best crops.

The effect of cultural treatment on the resistance of the buds is shown by the average for 1920-21:— percentages of flower buds dead on spurs:— Control trees (neither pruned nor manured) 46.3; pruned 34.0, pruned and manured 22.4, this was for the Richmond variety — respectively 25.6 — 10.0 — 6.4 for the Montmorency variety. Trees of insufficiently vigorous growth had 43.5 % and 17.0 % of flower buds on spurs killed by cold respectively for Richmond and Montmorency varieties, against 10.4 % and 4.9 % for trees of very vigorous growth.

**POLLINISATION AND FRUCTIFICATION.** — The Richmond and Montmorency varieties are autogamous and are able to cross-fertilise each other. Insects take no part in such fertilization; it is helped by wind, the position of the flowers is such as to assure natural fertilization by pollen falling from the flowers higher up the tree. The fall of immature fruit is not due to a failure of fertilization; all which were examined had been fertilised. Cultural attention affects fructification (percentage of flowers which develop into ripe fruit) as early as the following year, but the yield of a tree depends on the treatment it has received throughout its life. In observations made on Montmorency cherry trees brought under treatment in 1919 the figures were respectively for the control trees (unpruned and without manure), for a tree heavily pruned, for a tree moderately pruned, for a tree pruned and manured with nitrate of soda:— in 1919:— 31.3 — 48.8 — 39.7 — 49.2 cherries per 100 flowers — in 1920:— 30.9 — 44.8 — 39.2 — 42.9 % — in 1921:— 32.4 — 43.7 — 42.6 — 43.3 % — average:— 31.7 — 45.8 — 45.1 — %. The effect of a treatment is specially noticeable 2 years later. F. D.

**1316 — The Date Palm in Irak.** — DOWSON, V. H. W., in *Agricultural Directorate. Ministry of Interior, Mesopotamia*, Mem. III, Part. I, pp. 1-75, 54 figs., 1 map. Part II, 14 synoptic plates, 3 geographical maps, 4 diagrams. Cambridge, 1921.

The Irak date palm belongs botanically to the order *Palmeae*, gen. *Phoenix* sp. *dactylifera* L. The Shat Al'Arab Arabs divide the life of this palm into 5 periods:—

(1) "Farakh"	0 - 8 years after the 1st app of the bud on the mother palm after planting out	3 - 9	"	"	"	"
(2) "Khita"	"	4 - 20	"	"	"	"
(3) "Neshwa"	"	5 - 30	"	"	"	"
(4) "Rabaya"	"	12 - 60	"	"	"	"
(5) "Tawila"	"	30 - 100	"	"	"	"

The date palm is mainly distributed in the following areas:— Taflet in Morocco, Biskra in Algeria, Jerid in Tunisia, Fezzan in Tripolitania, in the Middle Nile valley, in oases in Arabia (Mecca, Medina, Jouf, Hofhoof, Hassa, Mascot, etc.). The largest area of its distribution, however is Irak. The date palm has recently been introduced into Arizona, Damaraland, Namaqualand and Australia.

In gardens where date palms are grown intercalary crops of other plants are easily arranged; in Irak the following are mainly found:—

A) TREES: *Juglans regia* — *Morus alba* — *Cydonia vulgaris* — *Ficus Carica* — *Pyrus Malus* — *Prunus persica*, *P. armeniaca*, *P. domestica*, *P. Cerasus* — *Citrus Medica* sp. et var. *acida* et *Limetta*, *C. aurantium* sp. et var. *Bigaradia* et var. *indét.*, *C. decumana* — *Mangifera indica* — *Zizyphus vulgaris*, *Z. Spina-Christi* — *Vitis vinifera* — *Punicum granatum* — *Olea europaea* — *Musa paradisiaca* — *Opuntia Ficus-indica*.

B) HERBACEOUS PLANTS. *Allium Ceba* — *Beta vulgaris* sp et var. *Cicla* — *Spinacia oleracea* — *Brassica oleracea* — *B. campestris* — *Raphanus sativus* — *Hibiscus esculentus* — *Daucus Carota* — *Solanum Lycopersicum* — *S. tuberosum* — *S. Melongena* var. *esculenta* — *Lactuca sativa* — *Cynara Scolymus* — *Allium sativum*, *A porrum* — *Lepidium sativum* — *Portulaca* sp. — *Trigonella Foeniculum-graecum* — *Apium graveolens* — *Petroselinum sativum* — *Foeniculum officinale* — *Mentha piperita*, *M. viridis* — *Lagenaria vulgaris* — *Cucumis Melo*, *C. sativus* sp. et var. — *Citrullus vulgaris* — *Cucurbita Pepo* sp. et var. — *Vicia Faba* — *Phaseolus Mungo* — *Vigna Catjang* — *Capsicum annum* — *Oryza sativa* — *Triticum* spp. — *Hibiscus cannabinus* — *Gossypium* spp. — *Medicago sativa* — *Lawsonia inermis* — *Arachis hypogaea* — *Sesamum indicum*.

The writer investigates in turn the soil conditions, cultivations, the problem of irrigation, methods of fertilization, harvesting and propagation. The date in ripening passes through 5 stages which the Irak Arabs call "Chimiri," "Khalal," "Rabab," "Tamar"; at Aden the 2nd and 3rd stages are called "Karra" and "Batta". During these stages the dates change in shape and colour.

The change of colour differs according to the varieties, especially during the "Khalal" stage when the dates may be yellow, red, yellow with red spots, etc. Dates for export should not be picked too ripe, for if the journey is long, ripening is completed during transit. The varieties exported from Basra are especially:— "Istaamran", "Halawi", "Khadhrawi", "Zahidi"; those exported from Northern Irak:— "Zahidi", "Khastawi", "Khadrawi." The export is considerable as, shown by Table I, which gives the value in lakhs of rupees (1 lakh of rupees is worth 10 000 pounds sterling at par) of the date export from Irak in 1919:—

TABLE I. — *Export of dates from Irak in 1919.*

Destination	In boxes	In baskets	Total
United Kingdom. . . . .	111	0	111
British India . . . . .	39	34	73
United States and other countries . . . . .	52	2	54
Arabia . . . . .	12	11	23
Persia . . . . .	1	1	2
<b>Totals . . . . .</b>	<b>215</b>	<b>48</b>	<b>263</b>

In 1919, dates predominated in the export trade of Basra, as shown by the following figures :—

Dates. . . . .	217 lakhs of rupees
Wheat . . . . .	27 " " "
Wool . . . . .	15 " " "
Hides. . . . .	7 " " "
Horses . . . . .	2 " " "

*Total 268 lakhs of rupees*

TABLE II. — *Export of dates from Basra from 1910 to 1912 and from 1917 to 1919 (in lakhs of rupees).*

Years	Dry dates	Fresh dates	Total	Remarks
1910 . . . . .	48	15	63	Figures from Consular reports
1911 . . . . .	53	16	69	
1912 . . . . .	58	12	70	
1917 . . . . .	3	70	73	
1918 . . . . .	1	40	41	Customs figures
1919 . . . . .	2	217	219	
<b>Totals . . . . .</b>	<b>165</b>	<b>370</b>	<b>535</b>	

*Average for the 6 years: = 89.*

TABLE III. — *Imports into India from 1910 to 1914.*

Years	Quantity in thousands of tons	Approximate value in lakhs of rupees
1910-1911 . . . . .	14	22
1911-1912 . . . . .	12	19
1912-1913 . . . . .	12	17
1913-1914 . . . . .	10	19
<b>Averages of the 4 years . . . . .</b>	<b>12</b>	<b>19</b>



These figures are for total imports; imports from Irak are consequently included in them.

TABLE IV. — *Quantities of dates exported from Basra in 1917 classified according to the principal varieties.*

« Syer » (« Istaamran ») . . . . .	36 576 tons
« Halawi » . . . . .	25 900 »
« Khadrawi » . . . . .	15 240 »
« Zahidi » . . . . .	4 064 »
<i>Total.</i> . . . .	<b>81 780</b> »

Their value was estimated at 73 lakhs of rupees. Packing is done in bags, baskets made from palm leaves, hide, one pound cartons, 10 pound boxes, wooden cases containing 68 pounds net weight.

The following portions of the tree are made use of: — the trunk of the date palm as timber — the pith of the growing point which is very nutritious — the fibre — the fronds — the mid-ribs of the fronds — their bases — the leaflets — the stalk of the bunches of dates.

DISEASES AND PESTS OF THE DATE PALM:—

- (A) A saprophyte, not very injurious, observed at Basra in 1920 on the trunk of date palms by Major C. R. WIMSHURST.
- (B) A *Tetranychus* (*Arachnidae*), observed in 1918 by Dr. BUXTON.
- (C) *Parlatoria blanchardii* (*Coccidæ*), common on the leaves of young palm and which cause serious injuries.
- (D) An *Oryctes* (*Coleoptera*) the larvæ of which attack the crown of the leaves.
- (E) The larvæ of a longicorn beetle (*Coleoptera*) which penetrates into the pith.
- (F) Trunk borers of the family of the *Gelechiidæ* (*Lepidoptera*) seriously injured date palms in Irak in 1918, 1919 and 1920; the inflorescences were attacked by the small larvæ of this moth.

This is, perhaps, the most dangerous pest of the date palm.

At the end of the 1st part of his paper the writer collects in a short vocabulary the Arab words used and explains them.

The 2nd part of the paper is entirely devoted to the results of an inquiry made by the writer in 1919 on the yield of the date palm in Shat All Arab. The writer has collected in a series of synoptic tables: — the number of varieties of female date palms in the district (about 50) — the distribution of the gardens in which date palms are exclusively grown and of those in which other fruit trees are also grown — data of the yield per garden, per variety and per tree — a list of the gardens with the numbers of date palms and the names of the owners — the percentage of date palms (78 %) and that of other fruit trees (22 %) grown in the district — the percentages of different varieties of date palms ("Istaamran" 45 %, "Halawi" 32 %, "Khadrawi" 8 %, "Dairi" 4 %, "Zahidi" 3 %, other varieties 8 %).

The paper ends with a bibliographical index of publications relating to the date palm. F. C.

## VITICULTURE

1317 - **The Viticultural Wealth of Greece.** — HASSIOTIS, S. (Director at the Ministry of Agriculture), in *L'Economiste d'Athènes*, Year II, No 25, p. 389. Athens, 2/25 May 1922.

Greece at present cultivates about 2 million *stremmes* (1 *stremme* = 10 *ares*) of land under vines. About  $\frac{1}{8}$  of this area is made up of vineyards of Old Greece. Vine growing is relatively very restricted in the new Provinces, except in the island of Crete.

Moreover, phylloxera had destroyed a large part of the vines in Macedonia and Thrace. Thanks to the strict measures taken in Old Greece, the vines there have been protected from every attack of the disease. Nurseries of American vines are prepared for replacing vines destroyed by phylloxera and at the same time measures for the control of the disease are studied. The production of must in Greece amounts to 3-6 million hectolitres a year, a quantity relatively small in comparison with the area cultivated. Intensive culture, the employment of chemical manures and an extension of the measures of control against various disease of the vine, especially mildew and oidium, would increase the yield very much. The vineyards of Greece fully suffice for the home consumption of wine and spirits and also allow of the export of fairly large quantities annually.

In 1920, Greece exported to foreign countries:—

Must	403 177 kg	to the value of	163 566 drachmas
Wine	28 404 218 " " " " "		22 172 374 "
Brandy	736 543 " " " " "		4 532 409 "
Lees	736 543 " " " " "		2 273 432 "

Total . . . 29 141 781 drachmas

These figures are certainly not remarkable for a country where the vine is under the best conditions for growth. Intensive cultivation of the vine, its protection against diseases and insect pests and progressive development and improvement of wine making promise a bright future for the export trade of Greece. The State, desiring to propagate as widely as possible viticultural and wine making knowledge, has established special sections at the School of Industries, at the College of Agriculture at Athens, which collaborates with provincial wine factories, at present few in number, and with a School of Arboriculture and Viticulture at Patras. The Roussopoulos Industrial Academy which has worked with success for several years also deals with the spread of viticultural and wine making knowledge.

Wine making establishments, formed by associations of vine growers, have recently been started in addition to those of large companies established long ago. This movement will certainly have satisfactory results for the production and trade of viticultural produce of Greece.

The production of raisins is estimated to average 140 million kg., of which  $\frac{9}{10}$  are currants and  $\frac{1}{10}$  sultanas, Cretan etc. The production

of currants amounts on the average to 280 millions of *Venetian pounds* (1 *Venetian pound* = kg. 0.450); it often exceeds 300 millions and sometimes falls as low as 200 millions of pounds. The quantity exported amounts to 250-340 millions of pounds. The remainder is used in industry for making wine, spirits, and syrup. Currants are grown on an area of about 700 000 *stremmes*, the average yield from which is 400 pounds per *stremme*. The cost of cultivation, before the war, amounted to 50 *drachma* per *stremme*; reckoning interest on the average value of each *stremme*, the production of 400 pounds of currants cost 80 *drachma* or 200 *drachma* for 1000 pounds. During the years of the war the cost increased to five times as much, consequent on mobilization, dearness of sulphur, sulphate of copper, manures, wages, etc. But the price of currants also increased proportionally reaching 600-800 *drachma* per 1000 pounds during the last two years. In 1921, owing to the rise in foreign exchange, the price has reached an average of over 1800 *drachma* per 1000 pounds.

The importation of foreign currency by the sale of raisins amounted before the war to 80 million *drachma*. In 1920 and 1921 the sum imported rose to about 200 million *drachma*, and it is estimated that in 1922 the sum that will be imported by the export of this produce will be 450 million *drachma*.

Raisins are grown in Greece to a great extent by the vine-growers themselves who employ also the members of their families on this form of cultivation, so that a large portion of the wages go to them.

G. A. B.

1318 - **Deep Ploughing of the Soil and Its Effect on Vine Chlorosis.** — ERRICHELLI, F., in *Giornale vinicolo*, Vol. LXVIII, No. 35, pp. 372-374, and No. 39, pp. 383-385. Casale Monferrato, September 17 and 21, 1922.

After a very wet autumn and winter, serious cases of vine chlorosis are often observed in the spring, especially on calcareous soils. This is due to the water, which is almost saturated with carbon dioxide, having dissolved a large amount of calcium carbonate. Owing to the coagulating power of the calcium carbonate the colloidal substances adsorb large quantities of iron salts, and the vine is deprived of the iron it requires. Similar instances have already been studied by PREIFFER in the case of the nitrogen adsorbed by calcic zeolites. Not only is the iron thus removed, but an excess of calcium bicarbonate is formed in the soil which neutralises the acid sap of the roots which plays such an important part in plant nutrition. In addition, an alteration of the texture of the soil takes place in calcareous land and this prevents the free circulation of air.

According to the hypothesis put forward by GOLLA, iron salts are the carriers of oxygen in the plant and thus control the respiration interchanges in the tissues. When iron is not absorbed chlorosis follows as a result of root asphyxiation. The various types of *Riparia*, which have very well developed organs of respiration and transpiration, turn yellow sooner than other vines if grown on calcareous soils. The vol-

ume of oxygen given out is larger than that contained in the carbon dioxide absorbed ; this excess oxygen is furnished by the salts of the cell-sap which undergo reduction (SCHLÖSING) ; to the same cause is probably to be attributed the yellow colour of the chlorophyll. If nascent hydrogen is bubbled through a solution of chlorophyll, the green solution changes colour until it becomes similar to that of the chlorophyll of chlorotic plants. Therefore this loss of colour is a reduction phenomenon.

In spring, owing to the rise in temperature, the adsorbent power of the soil greatly decreases, thus placing the nutrient elements at the disposal of the plants. This occurs much less in calcareous soils than in others, as owing to their slight permeability to water and gases, the ground long remains cold and ill-ventilated ; this adds to the troubles due to want of iron

On calcareous soils, deep ploughing is most beneficial, especially in preventing chlorosis. Soils that have been well-worked not only have the power of storing up more water than unploughed soils, but also encourage new reactions producing a store of heat which tends to decrease absorption and to promote the development of microorganisms. The coagulation phenomena are increased by the formation of hydrogels which impart a granular structure to the soil, further, the mineralisation of the organic matters is promoted, and the formation of organic hydro-sols which help in the formation of impermeable layers, is hindered. The author therefore advocates the frequent working of the soil at the proper seasons, and the application of a suitable organic fertiliser. A. de B

#### FORESTRY

1319 — **Storage of Coniferous Tree Seed.**—TILLOTSON, C. R. (Forest Examiner, Forest Service, United States Department of Agriculture), in *Journal of Agricultural Research* Vol. XXII, No. 9, pp. 479-510, 2 fig., Washington, D. C. Nov. 16, 1921

During the period from 1909 to 1913 the United States Forest Service was especially active in its reforestation programme, for which purpose large quantities of seed were needed. In the year 1910 alone 63,000 pounds of seed were collected. A good seed crop in any region is often followed by one or more very poor crops. In consequence it is desirable to collect during good years sufficient seed to last several years. The Forest Service followed this course and was then confronted with the problem of the storage of the seed so that it would not deteriorate greatly in germinative capacity and energy before it could be used. Similar problems had already been studied in Europe, chiefly by CIESLAR and by HACK, but they were confined to four species only, three of which were European. In order to meet an immediate need for information, it seemed desirable to extend them in order to include those American species most used in reforestation operations on the national forests. These species were western yellow pine (*Pinus ponderosa* Law.), western white pine (*Pinus monticola* Dougl.), white pine (*Pinus strobus* Linn.), Engelmann spruce (*Picea engelmanni* Engelm.), Douglas fir (*Pseudotsuga taxifolia* (Law.) Britton), and Lodgepole pine (*Pinus contorta* Loud.). The study should now be continued with the more sensitive

coniferous seeds, the true firs, the cedars, arborvitas, redwoods, and the numerous species of American hardwoods of which so little is known.

On account of the large number of variable factors involved (6 species of seed, 5 kinds of containers, 13 storage points, and 3 temperature conditions at each of these points), the general conclusions are by no means fully supported by the results in every individual test. It is thought, however, that the average results are a safe criterion of what may in general be expected from coniferous seed under storage conditions.

Fresh seed, with the wings removed, of the species previously mentioned was obtained during the autumn and winter of 1908-9 in the amounts and from the sources indicated below

*Picea engelmanni*, 10 pounds, San Isabel National Forest, Colorado

*Pinus monticola*, 55 pounds, Coeur d'Alene National Forest Idaho

*Pinus contorta*, 12 pounds, Deerlodge National Forest, Montana

*Pinus ponderosa*, 70 pounds, Boise National Forest, Idaho

*Pinus strobus*, 30 pounds, New York State

*Pseudotsuga taxifolia*, 25 pounds, San Isabel National Forest, Colorado

Each lot of seed was divided roughly into portions of about 600 to 800 seeds each, and these were distributed equally among the following containers:

- 1) Ordinary manila paper coin envelopes
- 2) Similarly envelopes soaked in melted paraffin
- 3) Cotton Cloth bags
- 4) Similar bags soaked in boiled linseed oil and dried
- 5) Glass bottles which after filling were sealed air-tight with paraffin

Seed of all six species stores in each of the five containers constituted one test set of samples. For convenience in handling, shipping, and storing, each test was placed in a small wooden box lined with a wire mesh to prevent the access of rodents.

It was one purpose of the study to determine whether seed deteriorated in storage to a greater extent in one geographical region than in another. Thirteen places of storage, were then selected from widely separated parts of the United States.

Another point on which it was hoped this study would throw some light was the effect of different conditions of temperature on seed in storage. At each of the geographical points mentioned, accordingly, the cooperators in the study were requested to store the seed under the following conditions of temperature:

1. Ordinary indoor temperature, such as an office shelf where the temperature would always be above the freezing point.

2. Fluctuating temperature, as in an outbuilding or unheated garret where the temperature would follow rather closely the actual outdoor variations. Proximity to a stable was to be avoided.

3. Fairly uniform low temperature, such as prevails in an unheated basement or cellar.

The study was planned to cover a period of approximately five years.

The seed was sent to the 13 points of storage during March, 1909. In January, 1910, and again in January, 1911, 1912, and 1914, three test sets (one stored at each of the three temperature conditions) were forwarded by express from each of the storage points to Washington, D. C. for testing.

Tests were then carried out after the seed has been in storage for one, two, three and five years. It is unlikely that seed in commercial quantities, would be stored for a longer time, but some of the seeds which had been stored in bottles were carried over for another five years and tested in 1917.

The seed-testing operation was a simple but rather large undertaking as during each of the four years 195 germination tests were made for each of the six species. Two hundred seeds were used in each test.

Ordinary green-house wooden flats were filled with fresh sand and the seed was scattered uniformly and covered with  $\frac{1}{8}$  to  $\frac{1}{4}$  inch of sand. The temperature was kept from 70° F in day time to 50° F at night. A careful daily record of the germination was kept, summarised by the A. in 9 tables giving the average germination per cent. for seed stored in different containers and under different temperature conditions, and also the average germination per cent for all 4 years at the different elevations.

The conclusions (based only on six species, and therefore not applicable to all species of coniferous seed) may be stated as follows:

1) Storage of coniferous seed in an air-tight bottle is far superior in every respect to storage in any other container. The average germination for the 5 year period, of seed stored in bottles over that stored in the next best container was 22 per cent.

2) Thoroughly air-dried coniferous seed stored in air-tight bottles is little, if at all, affected by such differences in temperatures as exist between a location where the temperature follows the natural fluctuations, a location indoors where the temperature never falls below freezing, and a location in an ordinary cellar or basement.

3) Coniferous seed stored in air-tight bottles is little if at all affected by the geographic location of the storage point.

4) The quality of coniferous seed, by which is meant its value in terms of both germinative energy and germinative ability is much superior in the case of seed stored in an air-tight bottle to that stored in any other receptacle. This is seen even at the end of one year of storage.

5) Following the air-tight bottle, the various containers, in the order of their merit, fall into the following sequence: paper bag paraffined, paper bag, cloth bag, and oiled cloth bag. It should be noted that an ordinary paper bag closed at the top is superior to a cloth bag for seed storage. The oiled cloth bag is practically worthless as a container.

6) The use of any of the containers except the air-tight bottle, results in such rapid deterioration after one or two years of storage under the temperature conditions of this experiment as to render the seed, particularly of Engelmann spruce, Douglas fir, and white pine, of very little worth.

7) Storage at the indoor temperature is superior to that at fluctuating or low temperatures. Storage at the low temperature shows the poorest results. This low temperature has reference not to a low uniform temperature of freezing or less but to that of an ordinary cellar or basement. The difference in germination percentage is not great.

under these three conditions but is sufficient to make indoor storage preferable to the other two conditions

8) Some geographic locations of relatively high altitudes and of low relative humidities stand out as exceptionally favourable localities for seed storage, others are unfavourable and should be avoided where ordinary methods of storage are followed. No one of the geographic locations shows marked superiority over another when the seeds are stored in airtight bottles

9) In respect to sustained vitality, the seeds employed in this study range themselves in the following sequence, with the strongest first: western yellow pine, lodgepole pine, western white pine, white pine, Engelmann spruce, and Douglas fir.

The striking superiority of the seeds stored in the air-tight bottles over those stored in any other container is particularly true when the storage period extends beyond one year and is more striking in the case of Engelmann spruce, Douglas fir, and white pine than in that of lodgepole, western yellow, and western white pines. The seeds of the first three species are apparently more likely to deteriorate than those of the last three and after two years of storage are of little worth.

The germination of the seed before it was put in storage was at least equal to that of the seed stored in bottles at the end of one year.

At the end of five years the bottle-stored seed of all species, except western yellow pine, is practically equal or superior to that stored for only one year in cloth bags, and the bottle-stored seed of western yellow pine is superior to that stored for two years in any of the other containers. Douglas fir, Engelmann spruce, and lodgepole pine seed stored in bottles, western yellow pine in oiled cloth bags, lodgepole pine in cloth and oiled cloth bags, and western white pine in paper and paraffined paper bags show some appreciation in quality at the end of the second year over that at the end of the first; there is in general a marked and fairly uniform deterioration of seed for a 3-year period, after which it is less rapid.

Various experiments with tree seed tend to prove that storage at a uniformly low temperature (0° to 32° F.) is preferable to that at higher temperatures

Ordinary basements and cellars for storing seed in unsealed containers are to be avoided and in northern temperate climates, storage indoors where the temperature never goes below freezing, is preferable to storage where the temperature follows the natural variations.

The bottle-stored seed in this study was not affected by climatic conditions at the points of storage. Two of the points, Dundee and Waukegan, which the study indicates were very unfavourable storage points when ordinary methods of storage are followed, appear in the case of bottle-stored seed to be among the most favorable locations.

Some of the bottle-stored seed exposed to the air at the end of 5 years, and afterwards resealed was carried over for another 5 years and tested in 1919, under the same conditions as in previous years. This part of the experiments cannot truly indicate whether seed can be successfully stored for 10 years without great deterioration, but does give an idea of the relative sustained vitality of the species concerned.

Engelmann spruce, Douglas fir, and white pine failed to germinate while Lodgepole pine germinated to the extent of 9 per cent., and completed its germination in 90 days, western yellow-pine 22 per cent. in 75 days, and western white pine 6.5 per cent. in 130 days. A. d. B.

1320 - An Investigation into the Relation between Height Growth of Trees and Meteorological Conditions. — HILAY, W. E. and CANLIFFE, N., in *Oxford Forestry Memoirs*, No. 1, Oxford, 1922.

Preliminary investigation into the relation between height, growth of trees and meteorological conditions from data were collected in Bagley Wood, near Oxford. The height increments of a number of vigorous young trees (average height  $2\frac{1}{2}$  metres) of different species were measured twice a week during the growing season of 1921. Some data had also been collected in 1920. These measurements were then considered in conjunction with different climatic factors, such as temperature, rainfall, sunshine, wind, etc. Special attention was paid to Sitka spruce, Corsican pine and European larch, in each case eleven trees being kept under observation. A few Douglas fir, *Pinus ponderosa*, *Abies grandis* and Japanese larch were also measured. Beech was taken as a type of broadleaved trees.

The conifers which were observed fell into three groups distinguished by the periods of growth:

- a) Corsican pine and Scots pine grow most rapidly at the end of May;
- b) Sitka spruce, Douglas fir, and *A. grandis* grow most rapidly in the latter part of June. In both these groups growth commences at the end of April and ceases in July or early August;
- c) In European and Japanese larch the whole growth was from two to four weeks later than in the other conifers, and growth was more regularly distributed over the whole period.
- d) Beech differs markedly from the conifers in that it grows very rapidly during May and only slowly during June and the early part of July.

The following table gives the maximum daily increment and the annual growth of the most vigorous tree of each species observed in 1921:

	Maximum daily increment in mm.	Annual growth in cm.
Sitka spruce. . . . .	22.0	83
Corsican pine . . . . .	13.3	43
Larch. . . . .	7.3	29
<i>Thuja plicata</i> . . . . .	4.3	16
Douglas fir . . . . .	15.3	49
Beech. . . . .	33.5	66

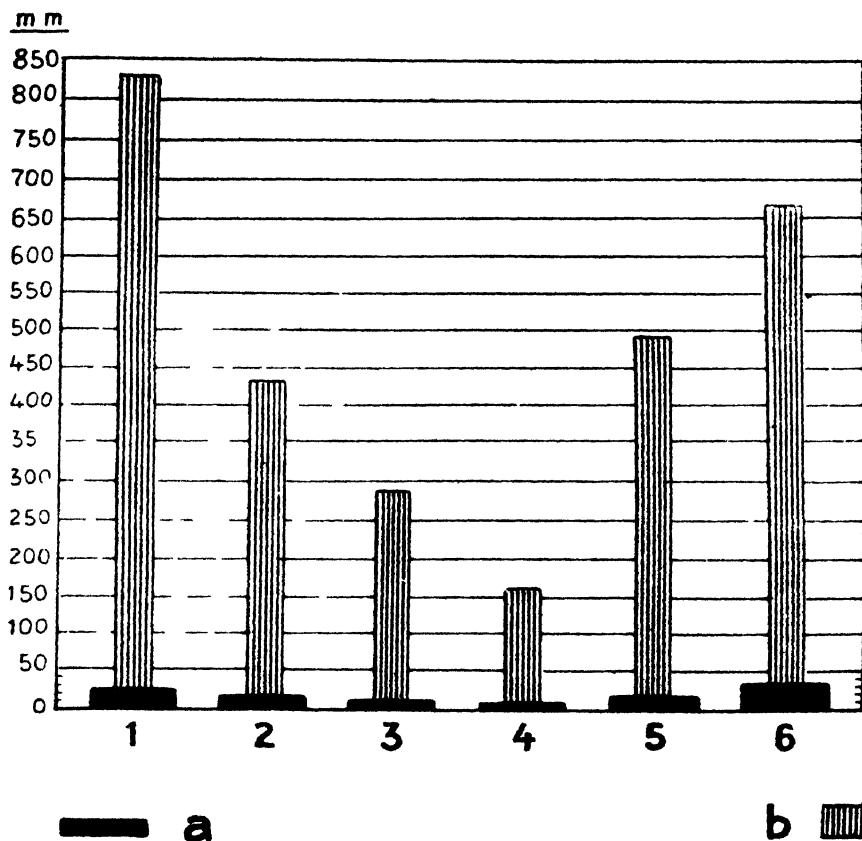
The figures for Sitka spruce and beech are about normal, for Corsican pine and Douglas fir a little low, while for larch and *Thuja plicata* they are very low. *T. plicata* showed a certain amount of growth during the winter of 1921-2, and also a small growth of the previous year's shoot during the growing season of 1921.



The effect of the hot, dry season of 1921 was both to shorten the growing season and to reduce the daily increments.

With regard to the influence of climatic factors on growth, in Corsican pine and Sitka spruce the closest relationship observed was that between

*Growth in height of same species of forest trees*



EXPLANATION

a = daily growth, b) = annual growth

1 = Sitka pine, 2 = Corsican pine, 3) = larch; 4) = *Thuja plicata*; 5 = Douglas fir; 6 = beech

the daily height increments and maximum shade temperature. It appeared that temperature was more important than all other factors put together in determining variations in the rate of growth. Larch gave a similar result when the mean shade temperature did not rise above 19°C and the water supply was sufficient as in 1920, but in 1921, when the mean shade tempera-

ture rose above 19° C there was an indication that growth was depressed.

The comparison of annual height increments of Corsican pine with temperature showed that an increase in mean air temperature during the whole growing period causes a decrease in the annual growth, whereas a rise in the mean daily temperature causes an increase in the daily increment. At present no explanation of these facts can be advanced, but it is suggestive that annual increment was found to be inversely related to mean soil temperature at 6 inches below the surface for May and June.

For good annual increment the rainfall of the growing period appeared to be more important than that of the previous winter period. G. A. B.

1321 — **Colonial Timbers and the Work of the Bordeaux Colonial Institute.** — *Annales de l'Institut Colonial de Bordeaux*, pp 193-207 Paris-Bordeaux, July-Aug 1922

The object of this paper is to prove that France can satisfy her timber requirements, which increased very much after the war (about 8 million cubic m. a year), without having to depend on foreign timber, by utilising the hitherto neglected forest resources of her Colonial possessions.

As a matter of fact the forest in French Colonies cover considerable areas as can be seen from Table I.

TABLE I. — *Forest areas in French Colonies.*

Tunisia . . . . .	500 000 ha
Algeria . . . . .	2 350 000 »
Morocco . . . . .	1 500 000 »
Ivory Coast . . . . .	12 000 000 »
Gaboon . . . . .	30 000 000 »
Cameroon . . . . .	12 000 000 »
Madagascar . . . . .	39 000 000 »
Indo-China . . . . .	25 000 000 »
Guiana . . . . .	5 000 000 »

Table II gives in a rather incomplete and approximate manner the exports from French Colonies properly so-called.

Detailed examination of statistics of timber exports from certain French Colonies to countries to which they were consigned show that before the war wood was sent to France in small quantities; a large amount was sent to Germany but since the war the quantity has always been small, for example, for the exports from the Ivory Coast from 1916 to 1920 the average was 14 % to France and 86 % to foreign countries (especially the United States and England).

Since 1917, the Bordeaux Colonial Institute has investigated the best means of utilising Colonial timbers; further, it encouraged botanical and forestry research so as to obtain still better knowledge of the species of trees which form the Colonial forests and which are known, thanks to the publications of PIERRE, R. P. KLAINE, LECOMTE and CHEVALIER (regarding the Ivory Coast and Gaboon), of CHEVALIER (regarding Tonkin),

TABLE II. — *Exports of wood from French Colonies from 1911 to 1920.*

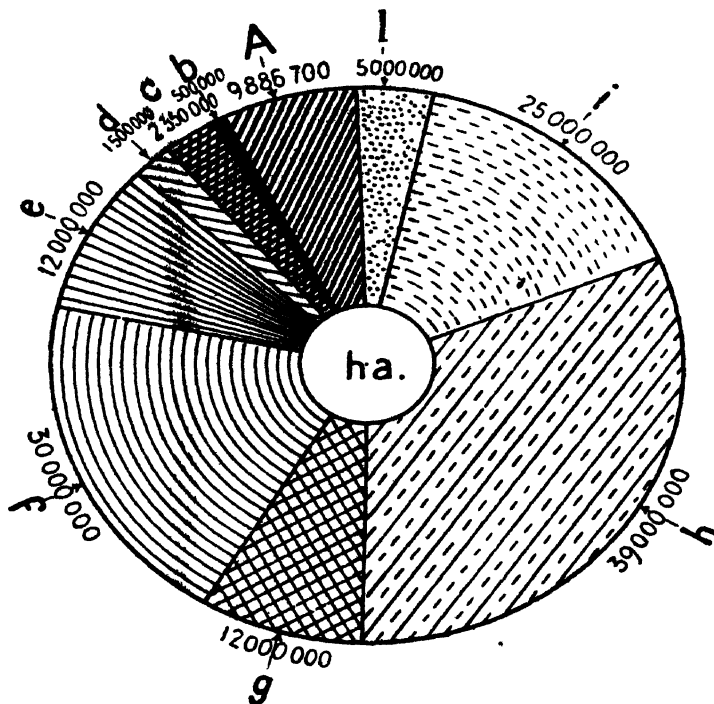
Woods	Ivory Coast	Gaboon kg.	Madagascar kg.	Indo-China kg.	Guiana steres
1911					
Common . .	—	—	3 248 168	8 143 745	7 900
Exotic . .	23 814 188 kg	102 240 000	1 116 773	524 943	20 955
1912					
Common . .	—	—	3 517 739	12 008 265	851
Exotic . .	30 489 783 kg	95 747 000	2 929 742	169 643	18 828
1913					
Common . .	—	—	1 622 540	11 700 552	23 135
Exotic . .	42 651 829 kg	150 688 000	4 857 594	160 289	308 835
1914					
Common . .	—	—	1 472 480	12 008 265	21 135
Exotic . .	41 054 563 kg	87 457 000	1 846 833	159 643	54 835
1915					
Common . .	—	—	2 558 011	—	877 597
Exotic . .	17 867 371 kg	18 762 000	948 419	6 196 000	1 083 850
1916					
Common . .	—	—	3 940 134	—	—
Exotic . .	8 133 steres	8 091 000	784 984	5 432 000	404
1917					
Common . .	—	—	2 920 023	—	—
Exotic . .	12 817 steres	4 646 000	79 049	4 793 700	558
1918					
Common . .	—	—	2 096 803	—	—
Exotic . .	37 388 steres	2 030 000	167 883	10 912 700	263
1919					
Common . .	—	—	5 359 916	—	—
Exotic . .	36 229 steres	—	564 089	8 568 700	558
1920					
Common . .	—	—	6 364 263	—	—
Exotic . .	61 682 steres	27 732 000	4 743 056	1 727 000	2 310

of LOUVEL (regarding Madagascar), of BERTIN (regarding the Ivory Coast, Cameroon, Gaboon and Guiana).

At the present time the forest trees of French Colonies are sufficiently known botanically and technically, but their exploitation presents some difficulties. To begin with, the predominance of a given tree never occurs in the Colonial forests, as it does in European and American forests, but such forests are formed of an approximately even mixture of many species, so that for profitable exploitation it would be necessary that all the different classes of trees should be utilisable:— timber for cabinet-

work, building timber, wood for paper pulp, etc. Moreover, there are serious difficulties as regards labour, especially in certain Colonies; these might be solved by temporary emigration. Lastly manufacturers and merchants must accustom themselves to make use of timbers from French Colonies.

*Area of forests in French Colonies.*



A	-	Area of forests in France.
b	-	" " Tunisia.
c	-	" " Algeria
d	-	" " Morocco.
e	-	" " Ivory Coast.
f	-	" " Gaboon.
g	-	" " Cameroon.
h	-	" " Madagascar.
i	-	" " Indo-China.
l	-	" " Guiana.

which can be advantageously substituted for more expensive foreign timbers.

To carry out the whole of this programme the public authorities must take wide action, helped in this matter by the various State organi-

sations and by every Colonial Government. To assist this movement, the Bordeaux Colonial Institute assembled, on the occasion of this year's fair, a Congress on Colonial timbers at which were to be discussed, by means of 11 committees all the scientific, technological, industrial, commercial, general and special questions regarding the utilization of the forest resources of the French Colonies, especially from the standpoints of the requirements of the Mother-country and of the commercial progress of the port of Bordeaux.

F. C.

1322 - **Atlas Cedar-Wood Oil.** — MASSY, in *Chimie et Industrie*, Vol. VIII, No. 2, pp. 464-465, bibliography of 11 publications. Paris, Aug. 1922

Atlas cedar-wood oil is obtained by distilling sawdust of *Cedrus atlantica* Mariette under water. It is a clear, yellow, balsamic liquid which becomes ropy at about 280°. It has remarkable pharmaceutical properties and can advantageously be used in place of sandal-wood oil in therapeutics. A small industry was started in Algeria, near Constantine and was afterwards abandoned; but the high price reached by sandal-wood oil has caused people at present to renew research on Atlas cedar-wood oil. The cedar resources are enormous; the forests of Middle Atlas could furnish at least 600 tons of oil a year, and as the production would exceed the requirements of the pharmaceutical industry, the use of the oil in the scent and soap industry should be tested.

A. de B.

## LIVESTOCK AND BREEDING

1323 - **Pathogenetic Consequences of Feeding Cattle on Cakes made of Cacao-Bean Shells.** — EBERHARD, in *Berliner Tierärztliche Wochenschrift*, Year XXXVIII, pp. 333-335. Berlin, July 2, 1922.

HYGIENE

The present dearth of the commonest stock-feeds has led several cattle owners of Caymen (East Prussia) to feed animals on their farms with cakes made from the shells of the cacao-bean. In 7 farms out of 10 where this new feed had been used, the animals showed signs of intestinal irritation and of diarrhoea; in 5, cutaneous affections in the form of diffuse eczema showed themselves, while the milk yield was considerably decreased. The author does not actually assert that all the above morbid symptoms are specifically due to feeding the cattle on the shells of the cacao-bean, although the decrease in milk yield is certainly attributable to this cause, as it showed itself when these shells were fed and ceased as soon as the latter were no longer given.

E. F.

1324 - **Lupinism in Horses.** — REINHARDT, R., in *Monatshfte für praktische Tierheilkunde*, Vol. XXXIII, Nos. 4-6, pp. 174-179. Stuttgart, June 30, 1922.

Four horses that had eaten a small quantity of lupins showed symptoms of poisoning, and three of them died after 7-8-9 days respectively.

All the animals suffered from a general disturbance of the circulatory system, had a high temperature, lost their appetite and were unable to retain urine; the mucous membrane, where it could be seen, was of a yellowish colour. In addition, each horse showed a special syndrome of symptoms. In the first animal, the nervous system was attacked (as was shown by cramp, spasmodic torticollis, trismus, and incapacity to keep on its feet); the second and third suffered from disturbances of the digestive system (colic, loss of appetite), and the fourth showed every sign of paralysis. Anatomical-pathological examination revealed serious lesions in all four horses, the liver being chiefly affected (parenchymatous hepatitis, jaundice), and petechial lesions occurred throughout all the organs.

Stress should be laid on the fact that a small quantity of unsweetened lupin seed was enough to produce such serious toxic symptoms that death was caused in three out of the four cases; further, it is noteworthy that blue lupins are as poisonous as the yellow variety. Horses appear to be much more susceptible than sheep to the toxic properties of lupin seeds; this had been already observed by several authors. The greatest caution should therefore be exercised in feeding lupins to horses; in all cases, the seeds should be sweetened and given in small quantities.

E. F.

**1325 — John's Disease (chronic bacterial Dysentery or Paratuberculosis of Cattle). —**

BRACH, B. A and HASTINGS, E. G., in *Agricultural Experiment Station, University of Wisconsin, Bulletin* 343, pp. 2-22, 6 figs. Madison (Wis.) May 1922.

JOHNE'S disease is so called after the name of the discoverer of the etiological agent but it also (according to various writers and countries) bears the names of paratuberculosis, chronic bacterial dysentery, Laaland disease (Norway), "Kaltbrandigkeit" (Switzerland), Serapie (England and Scotland). It is fairly common in England, Switzerland, and Denmark where it causes considerable losses; in 1908 it was discovered for the first time in the United States (Pennsylvania) by L. PEARSON, and has at present been reported in the territories of 8 States. Animals susceptible to the disease are cattle, rarely sheep and goats; the etiological agent is JOHNE'S bacillus, which enters the bodies of cattle in their food and drink and multiplies enormously in the walls of the intestines and in the lymphatic glands nearest to them. As the disease progresses many bacilli are excreted at the same time as the dung and may thus be ingested by other animals. The clinical symptoms show themselves slowly and it appears that at least 6 months must elapse from the time of infection before it can be clinically identified. A characteristic fact is the progressive emaciation which reduces the animal to a mere skeleton; the secretion of milk becomes very much reduced and may cease entirely; the eyes become sunk in their orbits as infra-orbital fat is lacking; generally there is no fever. Another obvious symptom is the diarrhoea which appears and disappears at irregular intervals. The syndrome might be mistaken for

that of tuberculosis, but the latter is excluded by the emaciated appearance and by there being no reaction to tuberculin.

Pathological anatomy reveals injuries of relatively small importance in comparison with the extreme wasting of the animal; it might be said that the only characteristic alteration is the thickening of the intestinal wall; it may vary in extent and degree, but is more often found as far up as the ileo-caecal valve and consists in the enlargement and thickening of small folds of the intestinal wall. Moreover, in the case of the normal intestine, the folds disappear when the wall is stretched, while they do not disappear when the intestine is diseased. The data available at present tend to show that the disease is transmitted from one herd to another by bringing an infected animal into a healthy herd. This is particularly easy owing to the fact, mentioned previously, that the clinical symptoms do not appear until long after infection has commenced. Two Englishmen, Messrs. TWORT and INGRAM who have used improved methods of research for diagnosing the disease in its early stages, have succeeded in preparing a substance similar to tuberculin, both in the way it is prepared and the method of use. This substance has up to the present given good results in Europe, and is now being subjected to verification tests in America. It is obtained by the culture, on special media, for at least three months, of organisms which cause the disease. At the end of the period the cultures containing the bacilli are heated so as to kill the bacilli, and are preserved by taking special precautions.

The disease does not appear to be transmitted directly by the mother to the new-born animal; but the separation of the mother from the young animal is certainly a good precaution to prevent the latter from being placed in an environment favourable for the contraction of the disease.

E. F.

1326 - **Disease of Newly-Born Rabbits.** — MILLO, N., in *Bassa Corte, Rivista degli allevatori d'Italia*, Year III, No. 56, pp. 1252-1256. Molassana (Genoa), August 1922.

The author has made a study of a disease which attacks recently-born rabbits. The number of these animals affected with this malady during the first few days of their life is very great and the result is always fatal. About 24 hours before death a viscous saliva is seen to flow from the lips and spread over the hair covering the cheeks; the animals lose their characteristic rigidity, and the muscles of the body relax, and the coat becomes excessively glossy, somnolence and lack of response to stimuli which occur during the early stages of the disease pass into a profound coma very soon terminating in death.

An anatomo-pathological examination revealed the characteristic symptoms of diffuse septicaemia; small, slightly mobile bacteria were found in the viscera. When death ensued on the fifth, or seventh day after birth, the pathological symptoms were more localised being especially noticeable in the intestines and lungs; sometimes dead individuals were found free from all signs of general congestion and haemorrhagia, only the

intestines and neighbouring glands showing any lesions. The number of the above-mentioned bacteria in the intestines was very large, but few of these micro-organisms found their way into the other organs, or into the blood. The author attributes the disease to these bacteria which resemble the common *Bacillus coli*, and is of the opinion that the malady is spread by the milk sucked from the dam, or else by umbilical, or possibly intra-vaginal, infection. He has succeeded in banishing the disease fairly quickly by carefully disinfecting the doe-rabbit both before and after the young were born, and by special disinfection of the hutches. The use of vaccin and serum is also to be recommended, as both kinds of treatment have given the same results.

E. F.

# FEEDING OF CATTLE

1327 - Present Cost in Germany of a Kilogram of Starch or its Equivalent in different Feeds as compared with that before the war. — PAROW, in *Zeitschrift für Spiritusindustrie*, Year XLV, No 39, p 265 Berlin, September 28, 1922

From the table given below it appears that at the present market prices ruling in Germany 1 kg of starch or its equivalent costs least in raw potatoes, and then come in progressive order dry potato pulp, potato flakes, maize, barley, oats.

As compared with 1912, potatoes show the minimum rise in price, then follow in progressive order dry pulp, flakes, oats, maize, barley.

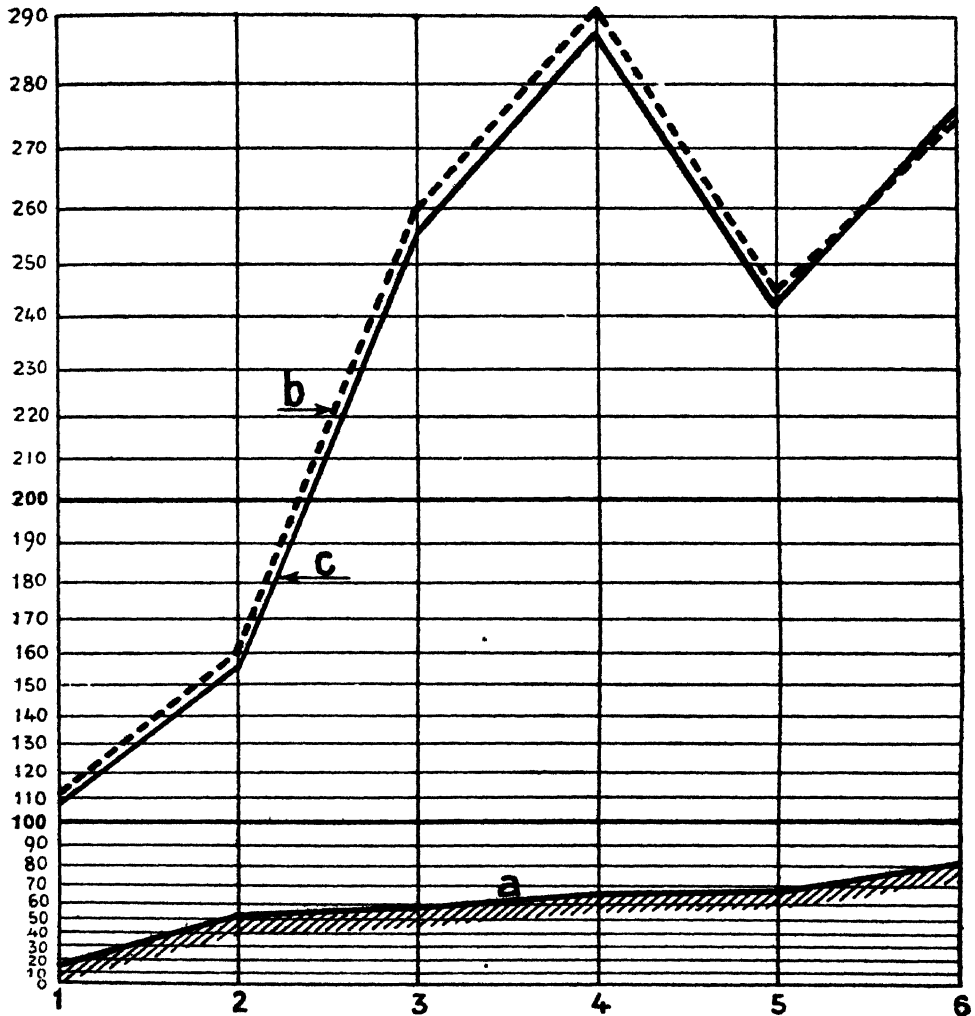
As regards the average increase in the price of feeds as compared with 1912, potatoes cost 111 times as much in September 1922, dry pulp 160 times, flakes 240 times, oats 260 times, maize 273 times and barley 291 times as much.

In comparison with oats, barley and maize, therefore, potatoes and potato products (flakes and pulp) show the least increase in price and

*Price on the German market of some feeds  
and of 1 kg of starch equivalent furnished by them*

Feeds	KELNER starch equivalent	Price in Marks per 100 kg.		Coefficient of Increase	Price in Marks of 1 kg of Starch Equivalent		Coefficient of Increase
		in 1912	in 1922		in 1912	in 1922	
Potatoes	16.9	4.5	5.0	111	0.27	29.59	109.6
Dry potato mash	50.9	10.0	16.0	160	0.20	31.40	157.0
Oats	59.6	18.9	49.0	260	0.32	82.22	257.0
Barley	66.6	16.5	48.0	291	0.25	72.07	288.2
Potato flakes	68.8	16.4	40.0	244	0.24	58.14	242.2
Maize	80.3	18.6	50.8	273	0.23	63.26	275.0



*Starch value of feeds before and after the War.*

## EXPLANATION :

$a$  = pure starch value according to KELLNER;  $b$  = relation between the local value in 1922 and 1913;  $c$  = relation between the local value in 1922 and 1913.

1 = potatoes; 2 = dry potato pulp; 3 = oats; 4 = barley; 5 = flaked potatoes; 6 = maize.

consequently in the last three feeds 1 kg. of starch value costs the least. F. D.

1328 - Comparison between Calcium Chloride and other Calcium Salts as a Stock Feed. — LOEW, O., in *Süddeutsche Landwirtschaftliche Tierzucht*, Year 17, pp. 13-15. Munich-Hanover, January 27, 1922

Calcium salts, the carbonate (chalk), and the phosphate have hitherto been fed to young stock in the form of a powder mixed with their rations, for the purpose of promoting bone development. Recent experiments have proved that the calcium salts present in the blood and muscles have other no less important functions than that of building up the skeleton, and must be regarded as factors essential to the normal working of the living organism. It is not known at present how much of the powdered calcium given to the animals is assimilated by the blood and tissues or in what percentage is absorbed by the stomach. In any case, it is necessary to administer the calcium salts in a form soluble in water and which can be easily assimilated.

The use of chalk, the calcium compound generally employed, has many drawbacks, as calcium carbonate is dissolved by the acid in the gastric juice, which acid is required for digestion and is indispensable for the digestion of albuminoid substances.

In order to produce any perceptible effect on the organism, a very large amount of chalk (50 gm.), must be ingested daily; this requires for solution 18 litres of gastric juice which is thereby completely neutralised and rendered relatively incapable of digesting the remainder of the ration. Further, the lack of gastric juice allows the numerous bacteria in the stomach to multiply freely. These statements have been proved by the results of some pig-feeding experiments in which the animals given maize, blood-meal and chalk developed more slowly than those that had received no chalk. The author is of opinion that calcium chloride is preferable to chalk, if given in much smaller quantities, as its effects are quite as beneficial and rapid as those of calcium carbonate and it has fewer drawbacks. In addition, calcium chloride is of therapeutic value in the case of certain specific diseases (diarrhoea, and sometimes in deficient bone development) whereas chalk has no such property.

Chloride of calcium is more expensive than carbonate of calcium, but is used in smaller quantities and produces a great increase in the live weight of stock, especially in the case of pigs. The results of experiments on young cows given carbonate of calcium showed an average increase in live weight of 100 kg., as against 126 kg. obtained with the chloride. In other experiments with 15 cows, the animals fed calcium chloride increased 10.1 % in live weight, while those given calcium carbonate only increased 8.5 %. If only the 6 youngest cows are taken into account, the average live weight increase was 20.5 % with calcium chloride, and 15.3 % with calcium carbonate. This shows clearly the superiority of the chloride, especially in the case of young, growing animals.

E. F.

1329 - **Hybridism in the Genesis of tame Races of Birds.** — GHIGI, A., in *Genetica, Nederlandsch Tijdschrift voor Erfelijkheids- en Afstammingsleer*, Vol. IV, No. 3-4, pp. 364-374. The Hague, May-July 1922.

BREEDING

The writer recapitulates the results of his experiments with poultry and pigeons, adding a few remarks on the value of hybridization in the genesis of tame races and consequently of species.

Ethical or physiological fixity is a necessary condition for taming a species or a race of birds.

Wandering and fixity seem to form a pair of antagonistic characters which perhaps, in their heredity, follow the rule of divergence.

For about twenty years the writer tried to breed, in full liberty, pheasants of the genera *Gennaeus*, *Catreus*, *Diardigallus*, *Crossoptilon*, *Chrysolophus* (that is to say those belonging to species which show least wildness in captivity) and he found that when the young birds became full grown they flew away and did not return. This was specially the case in late autumn and early spring when the seasons were changing. To this wandering is due the fact that the golden pheasant and the silver pheasant, which have been bred in captivity for centuries, have not become tame.

The writer tried crossing tame guinea-fowl (*Numida melcagris*) and *N. pitlorhyncha* imported from Erythrea (erratic but monogamous in the breeding season). He thus obtained some guinea-fowl which did not scatter and which bred. In succession he got several re-crossings even when at liberty; the progeny finally flew away.

In generations succeeding the first crossing of the two species of guinea-fowl, their distinctive characters may re-appear combined in a different correlation to that persisting in the parents and even combined with intermediate characters found in  $F_1$ . In a former publication (*Ricerche sistematiche e sperimentali sulle Numidinee, Memorie della R. Accademia delle Scienze di Bologna*, 1911), the writer also indicated the intermediate characters and new correlations which distinguish the geographical breeds, considered by ornithologists as distinct species.

Regarding poultry, the writer has recorded the fertility of hybrids between several tame breeds and *Gallus sonnerati*. He got progeny with Bantam chickens of the bankiva type, with cross-bred chickens between Java and Padua chicken and with "silky blacks" (1). He also had several reciprocal recrossings between hybrids of  $F_1$  and *Gallus sonnerati*, corresponding to the formula ( $\text{sonnerati} \times \text{bankiva}$ )  $\times$  bankiva. On the other hand the hybrids of  $F_2$  were few in number.

Generally, all the hybrids proved equally fertile.

*Gallus sonnerati* turned out quite sedentary; in view of the absolute fertility of its hybrids with tame poultry, it is possible that this species may have participated in the production of certain races of tame poultry.

(1) See: — A. GHIGI, *Ricerche sull'incrocamento dei Gallus sonnerati con polli domestici. Memorie della R. Acc. delle Scienze di Bologna*, 1916.

But it is impossible to say what these breeds are for the following reasons : — the  $F_2$  hybrids show a kind of general dominance of the characters of *bankiva* ; re-crossings with tame poultry loses all trace of the morphological characters of *sonnerati* ; re-crossings with *sonnerati* show decidedly the morphological external appearance of that species.

The hybrids of *Gallus varius* with *G. bankiva* have long been known under the name *G. temminki*. Breeding done in 1912 at the Berlin Zoological Gardens, and that done by M. HOUWINK at Meppel have proved, contrary to the general opinion, that these hybrids also are fertile, although the proportion of fertile eggs is low. Contrary to what has been verified in "sonneratic" hybrids, in hybrids with *varius* the characters of that species are dominant, and this dominance is shown also in re-crossings with *bankiva*. It is therefore possible that *Gallus varius* may also have participated in the production of tame races.

All tame breeds of poultry can be divided into 3 groups:— 1) homeosomatic breeds, in which the general form of the body and the correlation of its parts are such as are seen in various wild species ; they lay white eggs — 2) heterosomatic breeds, in which the form of the body and the correlation of its parts are very different from those of wild breeds ; these lay buff eggs (Cochinchina, Brama, etc.) — 3) breeds derived from crossing the first two groups.

The breeds of the first group may be considered to be descended from one or more wild species of the genus *Gallus* ; those of the second group probably belong to a species differing from *Gallus gallus*, reared entirely in captivity by man.

The writer made two series of experiments regarding tame pigeons. The first relates to the possibility of reproducing *Columba livia* by means of crossing the most dissimilar pigeons (A. CHIGI, Ricerche sull'eredità nei piccioni domestici, *Mem. R. Acc. Scienze, Bologna*, 1914) ; the second relates to the possibility of obtaining fertile progeny by crossing a tame breed with a wild species other than *C. livia*, *C. leuconota* (A. CHIGI, Sulla fertilità degli ibridi fra *Columba leuconota* e piccioni domestici, *Rivista italiana di Ornitologia*, 1919).

The following are the conclusions arrived at by the writer with the experiments of the first group :—

1) When several tame breeds of pigeon, differing in size and anatomic characters are crossed one with another, a form intermediate between those of the parents is obtained which varies between given limits and does not correspond with *C. livia* because it is larger and the beak is shorter and thicker.

2) If among the ancestors there were no pigeons having grey plumage with black bars, such as *C. livia*, and if there were not at least two possessing factors capable of reconstituting the combination found in *C. livia*, the plumage of that species would not appear in the descendants. It is therefore possible to get opposite results according to the groups of factorial combinations possible between the plumage of the parents. This result allows of the supposition that, even in pigeons, the larger

type is not related to *livia*, but to a large insular species domesticated in former ages.

In the second series of experiments, in which the writer crossed a tame pigeon of the "gazzo di Modena" breed with a hen *Columba leuconota*, he obtained a cock hybrid which fertilised the eggs of 3 tame hen pigeons of different breeds producing several young pigeons which, in turn, bred among themselves. He also got 2 hen hybrids, one of which laid many eggs all light coloured, while the other laid no eggs.

These hybrids, and three others which did not grow up, were all alike. Their characters permit of the conclusion that many oriental breeds of tame pigeons are descendants of hybrids between *C. livia* and *C. leuconota*.

Having mated a hybrid gander, produced by a cygnoid gander (*Cygnopsis cygnoides*) and a Toulouse goose, with two common geese, the writer noticed that all the eggs were fertile and produced a group (*Cygnopsis* × *Anser*) × *Anser*. This result showed that "Russian fighting geese" must be descendants of fertile crossing between cygnoids and the ordinary European goose: Tula and Armsamkaya geese are of this kind.

The possibility of obtaining hybrids between species of birds belonging to different genera depends on individual conditions and not on the breed. The protoplasm of the 2 species is chemically different and when the difference is great they do not react on one another; sometimes, for reasons unknown to us, the reaction takes place and a hybrid is then produced. This latter, generally, does not mature its gametes, but occasionally, in circumstances again unknown to us, maturation takes place and then we have secured the possibility of a line representing a new species.

F. D.

1330 — **Horse-Breeding in Dalmatia and Bucovina.** — PEIFFL, in *Zeitschrift für Gestutskunde und Pferdezucht*, Year XVII, No. 5, pp 53-87. Hanover, May 1922

HORSES

DALMATIA. — This country possesses 22 000 horses which when well-fed are wellgrown, high-spirited and very strong, but on scanty rations, as in the mountainous districts, remain undersized. They are used as pack-horses, and frequently made to carry too heavy loads. In order to improve the breed, the Government has distributed well-bred mares to the different Communes, and gives prizes for the best foals. Very satisfactory results have in this way been obtained.

The horses of the islands of Arbe and Pago are extraordinarily small, but are well-shaped with good legs.

On the plain of Sinj (Sinjsko polje, or Singer Feld), horses do better; races are held every year and games on horse-back.

In the mountainous parts of Dalmatia, the mule takes the place of the horse; the local breed of mules is small, but well-shaped and resistant.

A small-sized breed of donkeys is also in very general use.

BUCOVINA. — In order to improve the horses in this country, the Austrian Government established in 1819, the Radautz Stud-Station which

became a model of its kind. Before the War, Bucovina possessed 50 000 horses, viz., 5 per km.<sup>2</sup> and 8 per inhabitant;  $\frac{2}{5}$  of the population owned horses, and most of them possessed two animals. There were at that time: 21 000 mares, of which 5 000 were either in foal, or suckling foals — 22 000 geldings — 900 stallions — 9 000 colts and fillies. In 1819, the total number of head was 16 437, all light, strong, well-shaped animals, of distinctly Oriental type. Subsequently, Oriental stallions were used for the purpose of obtaining high-bred fast carriage and riding horses, while English sires were employed to increase the size of the breed.

The best horses are found at Alt-Fratanz, Satulmare, Radautz, Teiebestie, Hiszestie and Neu-Itzkani. In the country districts, the animals are often ruined by being insufficiently fed and worked too young.

In Kimpoling, Seletin, Solka, Uscze-Putilla and Wisnitz as in Galicia, the Huzulen horse of Oriental type is bred. It is very thrifty and strong, and without an equal in the Carpathians. Although this horse is much in demand, there are not many special breeding dépôts. The Huzulen breed furnishes all the stallions, these animals are supplied by the Radautz Stud-Station to private individuals. The characters of the breed depend upon the hard conditions under which it is bred, and are lost after the first generation when the animals are taken down to the plain.

In 1774, a Army Remount Station was founded at Kotzmann, but was transferred to Waskoutz 9 years later.

As however a large number of brood-mares had been bought for breeding purposes at the same time that the Army remounts were purchased, the Waskoutz estate was too small to accommodate all the animals, hence in 1788, part of the estate of Radautz was acquired, and in 1792, the remaining portion. This property occupies the whole valley of Suczava and extends 120 km from east to west up to the feet of mountains 1 600 m high. In 1868 the management of the Dépôt and Breeding Station passed from the War Ministry to the Ministry of Agriculture. The object of Dépôt, of which the organisation is described by the author, is stallion breeding to supply the State and the private Service Stations. The animals kept are half-blood English horses; half-blood Arabs of the heavier type, pure Arabs and Lippizas.

F. D.

1331 - **Horse Breeding in Hungary.** — MODSCHIEDLER in *Süddeutsche Landwirtschaftliche Tierzucht*, Year XVII, No 3, pp 25 33, figs 6 Munich-Hanover, February 10, 1922.

One section of the Hungarian Ministry of Agriculture is concerned with horse-breeding, and manages the 4 Government Stud-Stations (Bábolna, Kibér, Mezöhegyes and Godöllő), which are very important institutions, as 70 000 horses are annually exported from Hungary. Every year, usually in June, the horses are sent as required to the Service Stations. In order to provide service facilities, the country was divided, in 1915, into 4 sections with 15 stations each containing a larger or smaller number of stallions. The service period lasted from February 15 to June 15, after which the stallions were sent back to the Depots. Pri-

vate individuals could have their mares served by the Government stallions. Now-a-days, the Service fee is 2000 *crowns* plus a daily payment of 100 *crowns* for stabling. Before the War, 3000 stallions were necessary to meet the requirements of the different establishments, to-day 1000 stallions are sufficient owing to the reduction in the territory of Hungary due to the European War

. *All the breeds of horses now in Hungary* have been improved and purified by the introduction of English and Arab blood. The chief breeds are

The Muraközer — still found in the counties of Zala and Somogy. Height 160 to 172 cm. — ugly head — small eyes — short and thick neck — strong, thick mane — short, wide withers — wide flanks, muscular shoulders — wide croup — flat hoofs — powerful forelimbs. The coat is generally light chestnut, but it is sometimes of other colours, dark bay, or dappled with white

The Pinkasóer — very widely kept in the counties of Vas, Moson and Sopron — Height 165 cm — shape of head somewhat ugly — neck muscular — mane and hair of head thick — withers short — shoulders straight — chest and croup wide — very tractable. The coat is light or dark chestnut. This breed produces excellent horses for the plough and for draught purposes. It has been so much improved that no really pure-blood animals now exist.

The so-called "peasant horse" which has not been improved — height 165 cm. — head large in proportion to the body — back of average length — neck long — croup too long and narrow — good, but not very wide, chest — fore-feet sound — hind feet weak. Coat colour as a whole red. This animal has not a prepossessing appearance, but its resistance to fatigue and its thriftiness make it very useful for field-work on large agricultural farms.

The improved "peasants' horse" — height 165 cm. — the head, neck and chest are better formed, the shape of the croup is shorter and broader, but the breed is still in course of being improved; the most noticeable effects in this direction are to be observed in the south.

The so-called Erdely or Siebenburg horse is the result of a cross between the old Siebenburg breed and horses of Spanish blood. This animal is totally different from the peasants' horse. Shape elegant — head small and pretty — shoulders strong and short — legs good and strong. These qualities combined with its health and vigour make this horse very valuable and it is in great demand.

The Mokany horse is characterised by its conformation and is small and muscular with a wiry mane and tail. This breed is characteristic of the mountainous districts of the *comitats* of Máramaros and Ugocsa, and is found nowhere else.

The author mentions the following breeds of horses which are now being reared in different Stations in Hungary. — The Arab horse. This horse began to be bred in Hungary in 1506, the year in which the Bábolna Station became Government property. The stud which has been increased

by successive purchases now boasts of three stallions and 40 mares for the breeding of half-bloods.

The Lippiza horse has been bred since 1568 and is descended from the pure-bred horses reared by the Austrian Court. It is a good horse for riding and driving purposes and makes an excellent army mount. It is also most useful in mountainous countries. Its height is 166 to 167 cm. head finely shaped — neck strong and well-formed — mane thick — withers somewhat low — back long, broad and deep — croup rounded — chest wide — feet short, strong and muscular — coat white. These horses are slow in developing ; the foals are weaned at the 5<sup>th</sup> month and need much training in the riding-school. The breeding centre has now been transferred to Bábolna.

The so-called " quiet " horse is bred at Bábolna and is used for ploughing ; it is long-lived and its coat is usually bay. Breeding country horses was started in 1859 at Kiszér, with Percherons imported from France and replaced later by horses from the Ardennes.

The breeding of pure-blood and half-blood English horses was started at Kiszér in 1853 with pure-bred English stock and Arab mares from Bábolna. The Station now possesses 5 pure-bred English stallions and 13 brood-mares. The foals are trained for racing from their second year, and subsequently sold by auction, the Government reserving to itself the prior right of purchasing any foals it requires. The buyer of these foals is pledged to use them for racing and never to sell them out of the country. All these foals are suckled by their dams for 6 months ; from the third week, they are given as a supplementary food, oats of the best quality. They are accustomed to take cows' milk in order to avoid any digestive troubles due to an oat diet should the health of the dam not be good enough to suckle the foals the whole time. The pure-bred animals are characterised by a powerful frame and strong muscles.

The Kiszér Station for breeding half-bloods has been engaged in this work since 1870, and now possesses 6 stations and 168 brood-mares, most of them valuable animals, as the sires used for about 6 generations have all been pure-bred. The hybrids are somewhat too light and delicate, but these defects are easily remedied by mating the mares with Arab stallions. The Kiszér horses make excellent racers and carriage horses, for they are both fast and strong.

The Nonius horse which has been bred for some 35 years at Mezöhegyes, takes its name from its progenitor *Nonius*, an Anglo-Normand stallion with much English blood in its veins. The progeny of *Nonius* and his son (which numbered 6000 in 1895) are the results of crossing these stallions with mares of all breeds. Although not handsomely formed these hybrids are very strong and vigorous, being the strongest high-spirited horses in Hungary. The small type of Nonius is robust ; its height is 158 cm. The large type is strong, and lean, its coat is bay, and its height 192 cm. The Nonius breed is crossed with pure-bred English horses to improve its conformation and eliminate certain defects. The crossing must however not be too often repeated, for some of these defects



are characteristic of the breed and it is easy to obtain too light animals. Both types provide excellent horses for the plough, and for riding and draught purposes.

The Gidran breed is descended from an Arab stallion of pure type belonging to the Bábolna Station. This animal was first mated with mares of every breed, but was afterwards only allowed to serve English mares. The progeny thus obtained was of 2 types: one was very similar to the Gidran, the Arab characters predominating over the English, whereas in the second, the English characters were the more developed. The first type is more suitable for a carriage-horse, and the second for riding. As a rule these horses still show traces of their Arab ancestry. The present Gidran breed is characterised by its chestnut coat with golden lights, a white star in the forehead and fine action. E. F.

1332 - **The Importance of Breeding heavy Draught Horses in Westphalia.** — LINTER, in *Deutsche Landwirtschaftliche Tierzucht*, Year 27, No 11, pp. 107-110, figs. 5. Hanover, March 17, 1922.

In spite of the increasing use of machinery in agriculture and industry, horses are still very necessary, and the demand for them has not decreased as was anticipated in some quarters, but has rather increased. Before the War, the number of heavy horses required in Germany far exceeded the supply, and many were imported from abroad. The War took a heavy toll of the horses in all the belligerent countries, and only time can make good the losses suffered, but there is at present no actual shortage and the time is not far distant when the home supply will be all-sufficient.

There is at present in Germany a great demand for heavy cart horses, owing to the intensive agricultural development of the country. It is necessary on the modern agricultural farm to have horses capable of drawing heavy loads for long distances, and sufficiently docile to be easily managed by an inexperienced staff. This has led to the substitution of heavy cart horses of the Belgian-Rhenish type for the half-bloods hitherto employed. This new departure has become so noticeable of recent years in Westphalia that an observer is inclined to inquire into the causes that have brought about so radical a change in the views of the horse-breeder. In order to understand the change it is necessary to know some of the special characters of the heavy cart horse. This type can stand much hard work and costs relatively little to rear; its quiet disposition fits it also for every kind of work. It has however certain drawbacks that counterbalance these good qualities; it is a large eater, and slow worker; it is also more short-lived and less fertile than the pure-bred horse and much less resistant to disease.

One of the causes of the substitution of the heavy draught for the pure-bred horse, a change carried out in a few years, is that the type of thorough-bred produced by the breeders did not suit the general farmer. On the other hand it is true that heavy draught horses have now been introduced even where a light quick type would be more suitable.

In the author's opinion, breeders ought to change the type of their products and replace the pure-bred light horse by the half-bred, a thrifty animal with strong skeleton, and really fitted for agricultural work. Breeding heavy draught-horses necessitates intensive cultivation and the raising of forage plants capable of developing the massive frame of the breed. This horse will chiefly be reared where the fertility and character of the soil are most suited to the production of such forage crops.

The results obtained in modern breeding stations have shown that great importance must be attributed to ancestral qualities. The author mentions some especially famous stallions and emphasizes the fact that, if satisfactory results are to be expected, it is necessary to choose a sire of exceptional prepotency. The breeders' task therefore consists in collecting the best representatives of the best lines and taking proper precautions to avoid obtaining draught horses of too light a build which have lost the characters of their type, as is the case with many of those now reared in Westphalia.

E. F.

#### CATTLE

1333 - **Development of Cattle Breeding in the Palatinate: the Simmenthal Breed and the Place it Occupies in the Agriculture of the District.** — GÜNTHER in *Süddeutsche Landwirtschaftliche Tierzucht*, Year 17, No 9, pp 97-100 Munich Hanover, May 5, 1922

Statistics are available covering about a hundred years for Simmenthal cattle, breeding in the Palatinate. The importation of these animals from Switzerland was begun in 1780, and developed so quickly that in 1898, there were already 11 Simmenthal Breeding Societies. In the Swiss mountains, these cattle are either turned out to grass or stall-fed. The general cattle rearing conditions in the Palatinate are excellent owing to the climate, extensive plains, density of population and the development of agriculture. In the southern part of the district near Pirmasens and Zweibrücker the Simmenthal and Glan breeds are chiefly kept; towards the northwest and centre, native races are preferred, but Simmenthals are common in the north, where there are many breeding Societies.

Good Simmenthal cows were frequently imported from the Grand Duchy of Baden, and from Switzerland but did not prove prolific. High prices had to be paid for imported cows which did not turn out satisfactorily, though cattle bred in the country gave excellent results. Some of these cows fed chiefly on mangels weigh about 650 kg. and their average annual yield is about 3650 litres of milk containing 3.85 % of butter-fat.

On the small farms of the Lower Palatinate (Vorderpfalz) where the economic conditions are against the use of horses for agricultural work, Simmenthal cows and only occasionally oxen are used in the fields in preference to pure-bred or cross-bred native cattle. The author has obtained from two farms the data necessary for estimating the cost of keeping a Simmenthal animal. On the first farm, the feeding cost, taking into account the price of forage and grazing expenses, was 2531 marks for the first year, 1657 marks for the second, and 1053 marks for the first 6 months of the third year. The total general outlay amounted to 2041 marks. When

three years old, the cow weighed 420 kg., and its calf when sent to the butcher weighed 35 kg. and fetched 460 *marks* (1400 per quintal) as against 5460 *marks* (1300 *marks* per quintal) paid for the cow. On subtracting the latter sum from the maintenance cost (7282 *marks*), it is seen that the transaction ended in a deficit of 1832 *marks*, so that it does not pay to use expensive feeds. Further, the average weighings of several animals belonging to a Breeding Society show that a cow 25 months old should weigh 613 kg. which is much in excess of the weight (420 kg.) of the animals reared on the above-mentioned farm, although they had reached the age of 2  $\frac{1}{2}$  years. It may therefore be concluded that the feeding in the latter case was unsatisfactory and did not allow a normal growth.

The maintenance expenses of a Simmenthal animal on another farm were 1575 *marks* the first year and 2406 *marks* the second; the general cost amounted to 1902 *marks*. The total outlay was 6153 *marks*; the live-weight of the cow was 560 kg. and the price which it fetched (at 1300 *marks* per quintal) was 7250 *marks*. Thus there was a profit of 1097 *marks* due principally to the quality and extent of the grazing grounds which shows that under certain conditions a considerable profit can be made out of Simmenthal cattle.

The author considers that these cattle should be kept on farms where the ratio of pasture to arable land is 1 : 2 and where good returns are obtained from the crops. Under such conditions a fair profit can be obtained, but otherwise breeding Simmenthals may lead to a heavy loss.

E. F.

1334 - **The Advisability of continuing to Breed dual Purpose Cattle in Bavaria.** — STOCKELAUSNER in *Deutsche landwirtschaftliche Tierzucht*, Year XXVI, No 7 pp 66 68. Hanover, February 17, 1922.

For the prosperity and development of any branch of stock-breeding it is necessary that the breeders should know and formulate clearly their objects, these are determined by the physical and agricultural conditions of the country and the local requirements of the farmers. Bavarian cattle with the exception of the brown-grey mountain breed, are bred for meat, milk and work. Cattle-breeders have only recently considered the question of rearing single purpose dairy cows, in order to improve the yield and increase the fat content of the milk. The advocates of this new departure wish to regard the cow essentially as a milk producer and leave completely out of account its possibilities as a working animal. It is true that on many Bavarian farms the cows are not yoked and therefore the advantage of altering the present breeding methods is not very apparent.

Bavaria is a country of small holdings and it may be estimated that  $\frac{1}{3}$  of the total number of milch cows are employed in field work, which much reduces the cost of cattle breeding and sets off the high cost of keeping the animals. Work has the effect of decreasing the milk yield, but the value of the labour largely compensates for the deficiency in the milk obtained. Oxen are also used for agricultural work and to a much greater extent than horses. They cost less to keep than horses, for they graze during

the intervals of work and do not suffer from the lack of nourishing food. When there is little work to be done, the ox can be kept on a much smaller amount of food than the horse and can finally be fattened and sold as a valuable butcher's beast. The loss of time entailed by the slow work of the ox is of no consequence on small and average farms where the 8 hours day has not been adopted, and the owners have large families. It is also necessary to consider the possibility of breeding at the present day and with the feeds now available, a race of dairy cows. This involves a diet containing much albumen and therefore very expensive. Hitherto the basal rations of the milch cow in Bavaria, except in the mountain and pre-Alpine regions, have been the products grown in the cultivated fields, and whereas near the mountains, the pastures and meadows supply 75 % of the food required for cattle breeding, in the remainder of Bavaria only 17 % can be obtained from these sources. In summer, the cattle are fed clover and lucerne, and in the winter they must be given mangels and straw, as there is not enough meadow hay available. These rations, for instance, 8 kg. hay, 4 kg. straw and 15 kg. mangels, barely suffice for the production of 2  $\frac{1}{2}$  kg. of milk and must be supplemented on dairy farms by a fairly large amount of food rich in albumen. This difficulty can be avoided by keeping the cows at grass for at least six months, so that they can accumulate a sufficient reserve to enable them to tide over the period during which their rations contain little albumen. Arrangements could also be made for the cows to calve in the early spring, in order to make the lactation and grazing periods coincide. Another means of increasing the supply of albumen would be to grow larger quantities of albuminous plants for cattle feed. Cereals are not suitable for this purpose as their albumen content is only 6 to 10 %, horse-beans are rich in albumen (20 %) and should be cultivated wherever the nature of the soil permits. The small quantities of these beans which are grown everywhere can be turned to good account.

It is not however possible, even by feeding beans, to increase the amount of albumen in the ration sufficiently to give any considerable increase in the milk production. The quantity thus obtained will never exceed the average. It is not advisable to give cows lupins, for if these are fed to any extent, they have a deleterious effect upon the quality of the milk and butter and may also disagree with the animals.

For all these reasons the author concludes that it is not possible on most Bavarian agricultural farms to alter the breeding methods and only aim at milk production. Although it is necessary to try by every available means to increase the milk yield, the working qualities of the cattle must not be left out of account. It is only on certain industrial farms, where the cows are not used for agricultural work and the conditions are such as to insure a supply of food rich in albuminoids, that milk production can be the sole object of the breeder and every means employed to increase the milk yield.

E. F.

1335 - **Experiments on Cattle Feeding, in the United States Experimental Stations.** — SMITH, W. H. (University of Illinois), in *The Breeder's Gazette*, Vol LXXXI, No. 3, pp. 71-72, 2 figs. Chicago, January 19, 1922.

During the last two years United States breeders have suffered heavy losses in cattle breeding, the total of these losses being ascertained from information collected at the Experimental Stations. From experiments made in 1919-1920 by Experimental Stations in the States of Nebraska, Wisconsin, Missouri, Indiana and Pennsylvania, which reared 26 lots of 256 calves, a net loss of about 150 fr. per head may be inferred, similar results were obtained last season: 28 lots containing 247 beasts belonging to the Experimental Stations of the States of Nebraska, Iowa, Indiana, Minnesota and Pennsylvania showed a loss of about 132 fr. per head.

Breeders, remembering that during recent years rations containing a large percentage of maize silage, with or without a few grains of maize, had given better, or at any rate not worse results, applied to experts to know what quantity of maize should be added to the rations. To determine this quantity exactly experiments were conducted at several Experimental Stations. At the end of 1920 at the Stations of Nebraska, Indiana and Minnesota, rations containing no maize were fed to one lot of steers and it was ascertained that in every case the rations without maize gave the heaviest losses, while those with much maize, or of maize only, gave the smallest losses. These results taught the farmers not to rely on the results of previous years and thus adopt rations which might have been good in time of war, that is to say, when economic conditions were very different, but owing to present prices, were no longer profitable.

F. G. KING (of the Indiana Station) notes, in examining the data for a period of 5 years, that the highest profits were always obtained by feeding with maize only. It was not until 1919-20 that the use of silage foods showed greater profits while the use of rations composed partly of silage foods and partly of maize was never profitable. After ascertaining that the most profitable ration is that composed entirely of maize an attempt was made to determine how and when the nitrogen supplement should be given. At the Minnesota and Nebraska Stations, the supplement was given in the form of linseed meal cake, but at both it was noted that the loss was more or less increased. At the Indiana Station cotton meal cake was used with better results and the loss decreased by about 12 fr. per head. The experimentors at the Pennsylvania Station state that a nitrogen supplement is to be recommended and they tried to find out whether linseed meal cake or cotton meal cake was preferable. Linseed meal cake being laxative is more suitable for the steers, but it is better to use the cotton meal cake when the ration is largely composed of silage foods. The Stations have also made experiments with substitutes for cereals, introduced during the war, the use of which tends to be continued on account of the high cost of cereals. They have ascertained that the use of barley with molasses instead of maize has never given satisfactory results.

E. F.

1336 - **The Milch Cow in Italian Agriculture.** — I. ALPE, V., La vacca da latte nell'agricoltura italiana, in *L'Italia agricola*, Year I, IX, No. 9, pp. 281-284. Piacenza, September 15, 1922. — II. MORRESCI, B., L'opera di miglioramento delle razze italiane dai primi tentativi alle più recenti affermazioni, *Ibid.*, pp. 285-290. — III. GUARDASONI, M., Il controllo del latte alla stalla in rapporto alla selezione del bestiame lattifero, *Ibid.*, pp. 291-300. — IV. VEZZANI, V., La vacca Schwitz, *Ibid.*, pp. 301-312. — V. PARENTI, E., L'importazione e l'avvenire dei bovini olandesi da latte in Italia, *Ibid.* pp. 313-326. — VI. ZAGO, R., Ricordi zootecnici e impressioni di viaggio nei paesi d'origine del bestiame da latte, *Ibid.*, pp. 327-334. — VII. JOSA, G., Un esperimento di monticazione di bovini svizzeri di razza bruna nell'Appennino meridionale, *Ibid.*, pp. 325-338.

I. — Prof. ALPE draws attention to the importance of the milch cow in the improvement of Italian agriculture during the last 40 years and shows how correct GAETANO CANTONI'S formula is: meadow-live-stock-manure-corn, which he completes by a 5th term: chemical fertilisers.

The greater production of forage-grasses, which results from the more extended use of chemical fertilisers, gave rise to attempts to introduce breeds preeminent as store cattle, such as the Shorthorn, which several farmers of high repute have imported in the districts of Piacenza, Pavia, and Modena, and the "Modenese", introduced in the district of Vicenza, but little remains of these attempts, whereas the milch cow has become the rule everywhere. The consumption and demand for milk and milk products is continually on the increase in Italy, and the introduction of cream separators (tried for the first time in Italy by CANTONI in 1879 on the farm of the Royal High School of Agriculture at Milan), by making it possible to manufacture dry cheeses has also increased the total output of cheese.

Stock from which to breed and improve the milch cow is not lacking in Italy: the Alpine valleys, the Valteline, the districts of Brescia, Bergamo and Cremona can supply highly appreciated bulls of the brown Alpine breed; Sardinia (1) can supply the South of Italy with them.

As regards feeding, the farmers, thanks chiefly to the Agricultural Supply Associations, have excellent concentrated feeds at their disposal. In connection with labour, the Zootechnical School and the Cheese Factory at Reggio Emilia supply excellent stockmen, the travelling Agricultural Professorships also enable courses of professional instruction to be held for the peasants.

Co-operation, and especially Dairy Associations, have lent great assistance in several districts towards developing the dairy industry, both by raising the price of milk and by encouraging the farmers to improve the animals in every way. Among the new forms of Association may be mentioned the "Società di caricatori d'alpe" (Grazing Associations) and the "Casera" (Cheese Preserving Dépôt), established by the Reggio Emilia Mutual Aid Establishment, where cheeses belonging to the numerous small producers of "grana" are stored and very carefully preserved, these pro-

(1) See R. Dec. 1921, No 1250. (Fd.)

ducers receiving a substantial advance on the price of their merchandise, which they can thus sell without "corners" being made.

II. — Before the war 38 million hectolitres of milk per year were produced in Italy. This quantity has now once more been nearly reached and will soon be exceeded. Of this quantity, cow's milk constitutes  $\frac{4}{5}$  and the rest is ewe's and goat's milk. The dairy industry deals with  $\frac{3}{5}$  of the milk produced. In 1914 Italy exported a total of 80 million liras' worth of butter and cheese, which sum might now be equivalent to about half a "milliard" liras. The continual demand and importation of dairy cows, especially from Switzerland, is thus explained.

Of the two Swiss breeds (pied and brown) the brown is the most numerous in Italy, the cattle of the valleys of Lombardy, Piedmont and the Trentino are of this breed; it is found in the eastern districts and down in the plains which can be irrigated, where it supplies the flourishing milk industry. This breed has been successfully introduced not only in all the northern provinces of Italy, but also in the south and in the islands, for instance, in Molise, Calabria, Sicily and Sardinia.

The Simmenthal breed has spread to the Piedmontese valleys of Aosta and Orapa (Biella) and especially in Middle and Lower Frioul (1), in comparison with the brown Swiss breed, it is more sensitive to climatic conditions.

Several attempts have been made to introduce other breeds: the Danish in the Province of Treviso, the Breton in those of Brescia and Aquila, and the Jersey and Guernsey in Latium (2), but with little success. In the cool valleys of the Abruzzi the Breton race has developed and gives milk exceptionally rich in fat: 5.5 %.

An attempt has been made to introduce Dutch cows (of the Friesian breed) first in Piedmont and the Province of Piacenza, where the attempt did not succeed, but it was continued on a large scale in the district of Cremona. It has been observed that the Dutch breed cannot thrive where grass is not available all the year round, but as soon as this difficulty is overcome, it gives excellent results.

Another breed which has been imported is the Savoyard or Tarentese, greatly resembling the Swiss breeds. It is found on the eastern slopes of the Alps between France and Italy; the finest and most numerous specimens are found in the Province of Turin and in the mountainous part of the Susa and Pignerol districts, the periodical importation of selected breeding bulls from Savoy prevents the breed from degenerating.

The cattle from the Reggio and Modena districts, the Pisa cow and perhaps the cattle of Modica (Sicily) are among the Italian breeds preferred for milk production.

Those of the Reggio and Parma districts greatly resemble the Bernese, which are successfully used for their improvement. The Modena breed is actually of very mixed origin whence, in the neighbourhood of

(1) See R. 1921, Nos. 318 and 742. (Ed.)

(2) See R. 1916, No. 777. (Ed.)

Modena, come those which are strictly milch breeds and possess several characteristics peculiar to the Simmenthal cattle, with the exception of the coat, which remains whitish. The Modica breed cannot be termed a milch breed, though it includes individuals which are rather good milk producers.

As, generally speaking, the Italian cattle of Asiatic, Podolian or Hungarian origin, give a low and sometimes altogether insufficient supply of milk, it is better in breeding to keep the imported milch breeds pure, leaving work and meat production to the local breeds. At the same time crossing between the imported and the local breeds is very common.

Attempts have been made in Italy to cross the Schwitz bull with the Dutch cow (and vice-versa), and the Shorthorn bull with the Swiss brown cow. In the first case the result is half-breeds with a coat almost uniformly black, good for milk production, especially if the sire is Dutch, which also show a tendency to fatten well. In the second case, the improvement is only in the meat. No specimen of the Shorthorn dairy breed has yet been introduced into Italy. MORESCHI states that excellent results would be obtained by crossing the Shorthorn dairy breed with the Dutch.

There is a similarity between the "record" yields of the Dutch breed and those of the Swiss brown: the Royal Practical School of Agriculture at Brescia has a cow, of which the writer gives a photograph, which, for a whole month, yielded on an average 42.5 litres of milk per day.

In Sicily the utility of crossing the local cattle with the Schwitz bull has been proved, but its practical adoption is rendered difficult by the lack of forage; in Sicily, breeding improvement is primarily a question of forage production.

III. — An examination of the bulls to be approved for service can only be based on external features where there is no check on milk production; it is therefore not very reliable. The writer shows from the example of several countries the valuable results obtained by the organisation of this check on the increase of general milk production; he quotes British Columbia as an example of good organisation, and he finally explains how, in his opinion, this check should be carried out in Italy. The Breeders' Association of Cremona has taken the initiative in this direction.

IV. — The number of Schwitz cattle in Italy far exceeds that of cattle of the same breed in Switzerland, including the lighter-coloured types of the Grisons and the Canton of Tessin (about 40 %). In 1911, after the census, there were 545 588 head of brown cattle in Switzerland; the censuses of 1916 and 1918 do not distinguish between breeds, but they show that the number has not greatly changed. According to the Italian census of April 7, 1918, there were 1 215 695 cattle in Lombardy alone, of which  $\frac{2}{3}$ , and perhaps still more, belonged to the Alpine type more or less improved by the Schwitz breed, or the Schwitz pure breeds.

In Italy, a good Swiss brown cow when fed according to scientific methods gives on an average 3 000 litres of milk yearly, containing 3.75 to 4 % of fat; 4 000 litres is often reached, and exceptionally good animals exceed 5 000 litres.



Prof. VEZZANI shows the advantage of establishing in Italy distributing centres for this breed for the improvement of stock, such centres have already begun to be formed, especially in the Provinces of Cremona, Milan, and Brescia, and Bergamo and Sondrio.

The brown breed is eminently cosmopolitan.

The Swiss cow living in the valley of the Po is apt to change the colour of its coat, either towards white or light yellow. The writer thinks no great importance should be attributed to this variation in colour. Some Italian breeders indeed think that the Modenese and Piedmontese breeds, so appreciated for their three-fold qualities, spring from distant brown Alpine forbears, which change their dark coat for the present light yellow colour, grey or white.

By selecting breeding stock in the ordinary way, a point has been arrived at in the Cremona district at which, it appears, productivity tends to remain fairly constant. To intensify it there are two methods: 1) by means of milk records and the selection of bulls on the basis of the production of calving cows and their descendants, 2) by importing a better milk-producing breed, *e. g.* the Dutch. Thanks to the initiative of the Chair of Agriculture at Cremona, these two methods have been followed. The writer, without denying the possible advantage of adopting other breeds in certain well-watered districts, thinks that cattle-breeding in Italy should be based, on the whole, on the Schwitz breed, after selection and improvement.

The Expert, FRANCIS ZANELLI, of Cremona, observing that breeding should have been advantageous where there is no fear of a shortage of grass, for instance in the "marcite" of Lombardy, recognised the advantage, as early as 1872, of the importation of Dutch cows. The first importation was made in 1875 for the Farm of the Cheesemaking and Breeding School in Reggio-Emilia, of which Prof. ANTONIO ZANELLI was at that time Director, who alluded to the possibility of acclimatising, provided cool well-ventilated stalls were erected, — the feeding requirements and adaptation to the Italian fodder — regularity of breeding functions — the long duration of milk-secretion, which never ceases before the 40 days preceding calving — the high total yield — longevity — and the retention of the adaptability for milk-production by the descendants.

The importation of Dutch cows into Piedmont began in 1882; it afterwards continued without interruption until 1914, and recommenced intensively in 1921. Dutch cows have been introduced into several districts of Italy, and even into Sicily, but especially in the Province of Piacenza. Some establishments have been breeding Dutch cattle for about 40 years, and the fact that they form a large proportion of the clientèle for recent or imminent future acquisitions leaves no doubt as to the possibility of the adaptability of the Dutch cow in this Province.

Dutch cattle (1) belong to three distinct breeds, which are classed by the "Het Nederlandsche Rundvee Stamboek" Association as follows:

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(1) See *R.* May-June 1922, No. 606. (*Ed.*)

1) Pied black, from Frisia and North Holland 2) Pied red, from the Yssel, the Moselle and the Rhine; 3) white-headed variety from Groningen.

The numerous Breeders' Syndicates are united in two large Societies, each of which has a pedigree book. The General Dutch Cattle Pedigree Book Society ("Het Nedeilandsche Rundvee-Stamboek") and the Frisian Cattle Pedigree Book Society. The former has its headquarters at the Hague, and its operations for the improvement of the three breeds above-mentioned, as well as for that of heavy draught-horses, extend over the whole of Holland. It numbers at present 9942 members with an entry of 60,000 cattle. The second has its headquarters at Leeuwarden, its operations only cover the Frisian Province and are not concerned with pied black pedigree cattle born and reared on the farms in its own district; founded in 1879, it has obtained the most important results in the improvement of the local breed.

The writer describes the organisation of the control of milk production and of prize shows and also the keeping of pedigree books, which he extols as models, and points to their efficacy in the progressive improvement of production, both as regards quantity and quality of milk.

In the breeding of Dutch cattle in Italy, there is no doubt on two points: 1) the better adaptability of animals born in Italy, 2) the great success of the results of crossing the Dutch bull with local cows of the brown type, from the point of view of milk production, adaptability and vigour. The writer therefore in agreement with Prof. DE-CARLOS, Director of the Travelling School of Agriculture in the Province of Cremona, strongly advises the introduction of the Dutch bull, of good registered milch origin, into the stables of milch cows of the Swiss brown type, with the exception of those of the latter (a small number) where the brown type is bred especially with a view to the production of pure-bred selected breeding animals.

VI. — Prof. ZAGO alludes to his journeys to Switzerland and Holland to purchase cattle, he gives a survey of the organisation of breeding and fairs in Switzerland, and of the Dutch Societies for the Control of Milk Production and the keeping of the Pedigree Stock Book.

In connection with the Swiss brown cattle, he observes that, owing to the wide diffusion of late years of the improved cattle of the Schwitz canton in the other cantons, the type is now unique, having undergone fundamental changes and improvements, so that the primitive local sub-breeds have disappeared and the predominant type is that which has always been bred in Schwitz.

The animals which have been awarded prizes in the Prize Shows cannot be exported as they are retained by the Swiss Breeding Syndicates.

VII. — The Southern Apennines have a cool climate, good cultivated forage plants and possibilities of pasturage; it is therefore advantageous to replace the present cattle (of the Podolian type, chiefly adapted to work) by the milch-cattle of the Swiss brown breed. It has already been proved in practice that substitute crossing gives good results; but for cattle of the Swiss type to succeed, pasture is indispensable; now, it is asserted by several that the Southern Apennines do not afford pasture

suitable for grazing owing to the continual periods of drought to which it is subject, even at great elevations. The Travelling School of Agriculture of the Province of Campobasso, of which Prof. IOSA is the Director, has, for purposes of demonstration, made an experiment in grazing in the district of Matese, at a height of between 1400 and 1550 metres, keeping Swiss brown pure-bred heifers there from May 22 to Oct. 11, without other food than the open pasture, the animals being kept at night in an open enclosure.

The results were extremely satisfactory. The increase in live weight per head, for the 4 months' grazing, varied from 84 to 111 kg. with an average of 94 kg. The increase in the principal body dimensions were as follows: height of withers: maximum 13 cm., minimum 7 cm., average 10 cm. — length of body, respectively . 20 cm., 6 cm., 12.5 cm. — perimeter of thorax: 33 cm., 15 cm., 23.4 cm. From the economic point of view also, mountain grazing is very advantageous. F. D.

1337 - **Dairy Cow Breeding and Milk Production in Holland, especially as regards the Dutch Frisian Breed.** — MODSCHIEDLER, in *Deutsche Landwirtschaftliche Tierzucht*, Year XXIV, Nos 9-10, pp 87-91 and 99-101, figs 9. Hanover, March 10, 1922

The indigenous breeds of cattle in Holland are dissimilar in conformation and are employed for very different purposes

A. — The Groningen breed is native to the Province of the same name, but is now being gradually replaced by the black and white pied Frisian race. Groningen cattle are preponderant only on the Upper Rhine and west of Utrecht as far as Alfen; they are numerically much inferior to both the other breeds. A white-headed and a pied variety of Groningen cattle may be distinguished.

a) The white headed variety of Groningen cattle is stronger and heavier than the pied, these animals fatten very well. They are entirely black except for the head, belly, lower portion of the chest, the teats and the switch of the tail which are white. The head is fine and wide, the horns are slender, the barrel is rounded and the back well-developed. Although this is eminently a beef-breed, the udders of the cows are well shaped, so that milk yield is large. The live weight of the cows varies between 600 and 650 kg., their dressing yield is about 55 %. The milk yield is about 3700 kg. annually with a fat content of 3 %. These animals are chiefly bred in South Holland and in the neighbourhood of Groningen.

b) The pied variety of Groningen cattle has irregular black and white patches on the body. The average annual milk yield is about 3750 kg.; the live-weight of the cows when adult is about 525 kg.; two-year old bulls weigh as much as 625 kg. This variety is bred to the north of Groningen and south of the Ems canal.

B. — The Pied Red Breed is reared for milk and beef. It is the smallest of the Dutch breeds (1.25 m.-1.30 m. in height at the withers). These animals are generally red with the exception of the lower part of the chest and the belly, the lower portion of the legs and the front of the head, all of which are white. The head is coarse, the hide thin and fine, and the

chest deep, the horns are of medium length, white for most of their length, but yellow at the base and dark at the tip, the chest is deep, the legs are short, but well set. The live-weight is about 500 kg. and the cows yield annually about 3800 kg. of milk with 3 % of butter fat.

C. — The Pied Dutch-Frisian Breed is found in Frisia and in the North and South of Holland. It is a typical dairy-breed and widely kept, being characterised by its very high yield of rich milk.

These cattle have a long massive body, their live weight averages 525 kg. Three varieties can be distinguished.

a) The Frisian variety, of which the breeding centre is Frisia; it is white or pied-black, the latter colouring being preferred. The animals have a head of medium length, black with a small white patch between the horns, the neck and saddle are black, the rest of the body is white. Not infrequently a blue border marks the line of separation between the white and black. The bulls have strong black horns with tufts of hair upon the line uniting them. The body is angular, the back wide and powerful and the tail long with large switch. The milch cows have the well-formed teats and udder regarded as a sign of good milk production. Attention is now paid to the symmetry of these animals, although hitherto this character has been neglected. The live-weight of the cows varies between 500 and 600 kg. and that of the two-year-old bulls is from 600 to 700 kg. The milk yield is 4500 to 4900 kg. per annum, the fat percentage being from 3.05 to 3.20.

b) The Northern Dutch Pied Breed differs very little from the preceding; the white patches are more extensive, the hide is finer, the head wider and shorter, the chest deeper, the frame lighter and the muscles are better developed. The animals of this breed weigh some 100-200 kg more than the Black Frisian. Their annual milk production reaches 4200 to 4600 kg., the fat content being 3 %.

c) The Black Pied Breed of South Holland is a native of the islands of the coast of Central Holland and differs greatly from the breeds hitherto described. The animals are distinguished by their squat appearance, powerful muscles, strong frame and the very clear demarcation of the white and black patches. The horns are yellowish with black points, the neck is somewhat short, the chest deep and wide, the legs short, but well set on. The annual milk yield is about 4500 kg. with 3.2% butter-fat. Some of the cows give daily as much as 30 kg. of milk with 4.9 % of butter-fat.

As a rule, the farms in Holland are small; in some districts such as Frisia and North Holland, they are entirely engaged in breeding milch cows, in which case butter and cheese are made. In Utrecht and some parts of South Holland, where intensive pig-breeding is practised, whey is fed to the swine that are turned out to grass; 60-70 pigs can be reared with 25 dairy cows and 15 hectares of grass-land. Mixed farms consisting of  $\frac{3}{4}$  pasture and  $\frac{1}{4}$  arable land are chiefly found in the Southern islands of Holland, though they are also met with in the North. In the latter region, cattle are raised intensively on grazing, beets, beans, oats and clover. No cheese, is, however, made on the farms neither are any pigs kept, for all the

milk is at once taken to the great cheese factories in the neighbouring town.

The cattle breeding is very well-organised. The State gives prizes for bulls and supplies funds for the purchase of bulls and cows for breeding purposes; it has also established agricultural schools with the status of secondary schools. There are Bull-keeping Stations, Cow-testing Societies and Breed Societies. An interesting innovation in scoring has been adopted at Shows and Competitions, consisting in giving 100 points to each cow according to the quality of its different organs; no cow that has been accredited with less than 75 points may be entered on the pedigree Herd-book.

It is evident that in a country like Holland, where the different breeds of cattle are reared and valued for their milk production, the dairy industry is of great importance. Except during 3 or 4 months, the cows are milked in the field and a good milker is highly esteemed. Holland manufactures several kinds of butter, which are exported chiefly to England and Germany, sour butter, sweet cream butter, "whey butter" and centrifugated butter. Cheese is made in Holland to the extent of 90 million kg. annually and is exported to Germany, Belgium, England and France, in different forms and qualities, under special local names.

The Dutch cow-sheds are of the old type, the cows face towards the main wall, the food has to pass between the animals on its way to the manger and the water is distributed in buckets. The two principal drawbacks of such sheds is their low floor and the difficulty of drainage. Most of these defects have been corrected in a new type of Dutch shed. A third type is adopted in the cheese-factories in which the cows are arranged in two rows with a common manger between them.

The calves are given from three to four litres of freshly drawn milk daily for the first fortnight, after which they are also fed with other very nourishing foods. They are then put out to grass, but still receive three litres of milk and half a kilo of nutritive substances. On some farms, the calves are given milk alone for the first two months and afterwards whey with finely-ground maize until the tenth month.

E. F.

1338 — **Effect of Variations in the daily Yield and in the Diet on the Composition of Goat's Milk.** — TAYLOR, W. and HUSBAND, A. D. (Rovett Research Institute, Aberdeen), in *The Journal of Agricultural Science*, Vol. XII, 2nd part, pp. 111-124, 3 diagr. Cambridge, April 1922

GOATS

Experiments regarding the influence of the diet on the compositions of milk have often given somewhat divergent results. Thus VOIT (1869) found, by experimenting on a bitch, that an excess of one constituent in the ration tended to increase slightly the percentage of the same constituent in the milk but the deviation from the normal composition was relatively small. INGLE (1901) found that a diet rich in protein increased the production of milk and its fat content. CROWTHER (1917) found that a diet rich in protein caused a decrease in the quantity of milk but increased the fat content. JORDAN and JENTER (1917) ascertained that the amount

of fat in the ration had no influence on the percentage of fat in cow's milk. MORGAN, BERGER and FINGERLING (1904) found in their experiments on goats that a diet poor in fat produced milk with a small percentage of fat. The writers remark that in the modifications introduced into the rations its calorific value is not always taken into account, for which reason the effect of changes in the ration may have been attributed to modifications in the constituents of the ration. Moreover, modifications in the volume of milk produced, as well as in its fat content or in the effect which the former has on the latter have in neither case been always taken into account. For these reasons the writers were induced to submit the question to fresh experiments.

I. — EFFECT OF VARIATIONS IN VOLUME ON THE PERCENTAGE COMPOSITION OF THE MILK IN THE CASE OF A GOAT KEPT ON A DIET OF UNVARYING COMPOSITION. — 1) The milk from 2 daily milkings was mixed, and the volume — percentage of protein — casein — albumen + globulin — non proteic nitrogen — fat — lactose — ash — were determined. As the goat was in an advanced stage of lactation, the volume of milk was continuously decreasing. The statement of HAMMOND and HAWK and other writers to the effect that there is an inverse ratio between the percentage of fat and the daily volume, was confirmed, it was also ascertained that the percentage of protein varies inversely to the volume, at least as regularly as that of the fat, although the variation is less marked. The percentage of lactose remained almost constant, and only varied between 4.19 and 4.30 %. The percentage of ash (0.94-1.08) showed a tendency to increase with the decrease in the volume of milk produced. The volume of milk in 24 hours and the percentages ascertained respectively on the 1st, 8th and 16th day of the experiment were:— 310 — 240 — 145 cubic cm. — Protein:— 4.50 — 4.86 — 5.40 % — Casein:— 3.07 — 3.41 — 3.79 % — Albumen + globulin:— 1.20 — 1.24 — 1.37 % — Non-proteic nitrogen:— 0.23 — 0.21 — 0.24 % — Fat:— 4.54 — 5.62 — 5.94 % — Lactose:— 4.26 — 4.35 — 4.30 % — Ash:— 0.98 — 0.97 — 1.04 %.

2) A goat was fed for 8 days with unlimited quantities of hay and oatmeal; for 2 days she was given nothing to eat, and beginning with the 11th day she was fed as before. The decrease and fresh increase in the production of milk were accompanied by the following changes in composition:— *at the end of the 1st period of feeding*:— Milk 460 cubic cm., Protein 2.93 %; Fat 3.95 %; Lactose 4.07 %; Ash 0.79 % — *the 2nd day of fasting, respectively*:— 50 cubic cm. — 9.24 — 10.16 — 2.31 — 1.37 % — *the 2nd day after renewed feeding*:— 350 cubic cm. — 2.52 — 4.81 — 4.23 — 0.91 % The decrease in the volume of milk was therefore accompanied by an increase in the percentages of protein, fat, and ash, and a decrease in the percentage of lactose.

3) and 4) The writers analysed the milk of a goat at the beginning and end of the lactation period respectively; they found that the natural decrease in the volume of milk is accompanied by the same variations in composition as those caused by fasting. It is therefore possible to formu-

late the following general principle :— with a diet of unvarying composition, the percentages of all constituents of the milk except lactose, tend to vary inversely to the volume of milk secreted ; the percentage of lactose, which is normally very constant, tends to vary directly with the volume, and such variation is especially marked at the beginning and end of the period of lactation.

II. — INFLUENCE OF DIET ON THE VOLUME AND PERCENTAGE COMPOSITION OF THE MILK. — 5) After establishing the above principle in the case of a diet of unvarying composition, the writers investigated the extent to which it would be modified with diets containing an abnormally large quantity of one of the powerful constituents, protein, fat, carbo-hydrates. The results are summarized in the following Table. In calculating the average percentages of protein in the milk, non-protein nitrogen was excluded. The ration rich in fat consisted of :— 525 gm. of hay + 243 gm. of groundnuts + 102 gm. of oatmeal + 266 gm. of crushed carob-beans + 71 gm. of sugar ; the ration rich in proteins was composed of :— 560 gm. of hay + 300 gm. of " plasmon " + 535 gm. of oatmeal ; that rich in carbo-hydrates of : — 586 gm. of hay + 374 gm. of crushed carob-beans + 531 gm. of indian meal + 98 gm. of oatmeal. The calorific value of the rations was respectively 4225 — 3702 — 4636 calories.

*Average daily volume and percentage composition of milk for each diet period.*

Nature of diet	Volume of milk produced in 24 hours	Protein	Casein	Albumen + globulin	Non-protein nitrogen	Fat	Lactose	Ash
	cubic cm.	%	%	%	%	%	%	%
Rich in fat (14 days) . . . . .	395	4.14	3.20	0.94	0.20	4.40	4.23	0.96
Normal (9 days) . . . . .	319	4.66	3.39	1.27	0.23	5.33	3.90	1.10
Rich in proteins (16 days) . . . . .	533	4.34	3.23	1.11	0.39	3.23	4.05	0.93
Normal (5 days) . . . . .	380	4.42	3.43	0.99	0.26	4.40	3.91	1.08
Rich in carbo-hydrates (13 days) . . . . .	439	4.42	3.34	1.08	0.16	3.52	4.17	0.92

In no case, was there a direct increase in the percentage of the constituent of the milk corresponding to the constituent in excess in the diet. Proteins, fat and ash all tend, though in different degrees, to vary inversely and lactose directly with the volume of milk secreted daily. Variations in the composition of the milk undoubtedly occur with the different diets, but these variations were of such a kind and degree that they may be attributed to variations in the amount of secretion and consequently in the volume of milk produced daily. Several other feeding tests gave similar results. In one of them, the ration rich in protein (305 gm.) contained

only 3700 calories, against 4230 for that rich in fat (136 gm.) and 4630 for that rich in carbohydrates; the volumes of milk obtained in 24 hours were respectively 540 — 400 — 440 — cubic cm. Proteins therefore have a marked stimulating effect upon the secretion of milk. Non-proteic nitrogen on the other hand, is directly proportional to the diet.

In conclusion, it appears that the percentage composition of milk is determined by the intensity of secretion, diet has no direct effect, except in the case of non-proteic nitrogen, which is not a product of the mammary gland; but it has an indirect influence through its effect on the volume of milk produced daily. A diet rich in proteins stimulates the secretion of milk (1).

1339 — **Rearing young Pigs without Milk Rations.** — SANDBRINK, in *Zeitschrift für Schweinezeitung*, Year XXIX, No 8, pp 116 121 Neudamm, May 1, 1922.

Milk has always been much used in rearing young pigs and before the War it paid well to employ milk for this purpose. On the other hand, the supply of milk has decreased of late years, whereas the amount required to meet the requirements of the population has increased, so that breeders no longer include milk in the rations fed to their pigs. In order that the young animals shall not suffer from this change, the author advocates the rearing of sows with abundant milk production that will suffice for the whole litter of little pigs. He mentions some instances observed at the Ruhlsdorf Experimental Pig-Breeding Station. One sow had sufficient milk, to feed the 9 piglings of her fourth litter for 3 weeks when they reached the average weight of 16.7 kg. In addition, although she had been served again on the 6th week, she acted as foster-mother to 5 other young pigs for 3 weeks. The same sow had suckled 11 out of the 15 piglings of her first litter. These little animals weighed on an average 14.64 kg. at the end of 10 weeks.

A second sow reared until fully grown 7 young pigs of her 3 first litters and transmitted to her descendants this extraordinary capacity of milk production. One of her daughters reared for 10 weeks 10 little pigs, which attained the average weight of 8.82 kg. and suckled 9 pigs of her second litter. A third sow suckled for 10 weeks 9 young pigs till they reached the average weight of 23.22 kg. (one weighed as much as 28 kg.). The sow lost 25 kg. whereas the ordinary decrease in weight during the 10 weeks' suckling (at Ruhlsdorf) is only 10 kg., and the customary weight attained by the little pigs is 15.2 kg.

In order to increase milk production, the author advises feeding sows for 5 weeks before farrowing and throughout the suckling period, with nutritious foods rich in protein (2), and accustoming the young animals,

(1) A paper by R. W. CLOTHIER entitled "Seasonable Variations in Butter-Fat Content of Milk in Southern Arizona," accompanied by a bibliography of 100 publications has appeared in *Society for the Promotion of Agricultural Science, Proceedings* Vol. 30, pp. 75-112, 1929, and was revised in *Experiment Station Record*, Vol. 46, No. 7, p 679 Washington, May 1922 (Ed.)

(2) The breeder must vary the quality and quantity of the food according to the particular sow, for no two animals are alike in their requirements (Author's note)



from the beginning to take other foods in addition to the sow's milk. In this way the dam loses less weight, the litter fattens more rapidly, and the sow can be served again after the 6th week without the young pigs suffering from the necessary change in the milk of their dam, as they are already able to consume large quantities of solid food.

E. F.

1340 - **Summer Pig-Breeding in Germany.** -- MÜLLER, in *Deutsche Landwirtschaftliche Jahrbuch*, Year XXVI, No 2, pp 15-17 Hanover, January 13, 1922

Rearing pigs in the summer and turning them out to grass is very profitable both from the economic and hygienic standpoints, for the animals do not require artificial feeds which are scarce and costly, while from passing many hours in the open, they become more robust and disease-resistant. On the other hand, care must be exercised in the choice of a grazing-ground, which must be under young grass, for the pig unlike the ox, cannot eat large quantities of indigestible food. The grazing question having been settled, it next remains to decide whether supplementary food should be given. This depends upon the quality of the pasture and the stage of the animal's development. The author gives in this connection the results of three experiments carried out at the Ruhlsdorf Experiment Station.

During the summer of 1919, 17 pigs varying in age from 12 to 16 months were turned out from the middle of May to the middle of September into a field of cereal stubble, clover, and irrigated meadow-grass. In spite of the dry summer, the animals found plenty to eat and increased in live-weight 166 gm. per head and per day.

In 1920, 8 adult and 7 young sows were kept at grass in an irrigated field. The experiment was to have lasted 4 months, but was reduced to 11 weeks, as the animals were about to farrow and therefore needed the addition of a ration rich in albuminous substances. The older sows behaved as usual, their average increase being 11.5 kg. per head; the younger sows only increased 5.95 kg. in weight, although the gain proportionate to that of the other sows and to their own initial weight would have been 7.5 kg.

In 1921, the animals were first grazed on meadow clover and subsequently on an irrigated meadow-grass; only adult sows were turned out, their average increase in live-weight was 13 kg. It should be noted that the weight of the sows diminished after the litter was weaned because the nutritive value of grass is relatively less than that of the albuminous substances fed during the suckling period.

The above-mentioned instances show that it is possible to keep adult swine at grass. The author has carried out experiments to determine whether young pigs can pick enough food in the fields, or require a supplementary ration. Sixty-six young sows were divided into 6 lots. The 1st received meadow-clover and  $\frac{1}{2}$  kg. (per head and per day) crushed soya; the 2nd was only given meadow clover; the 3rd had irrigated meadow-grass and  $\frac{1}{2}$  kg. soya; the 4th only irrigated meadow-grass; the 5th

a special grass mixture (1) and  $\frac{1}{2}$  kg. soya — the 6th only the mixed pasture.

The animals used in the experiment were 7 months old ; their average initial live-weight was 60 kg. The results obtained showed that the increased weight per head in the lots given soya in addition was 100 gm. ; the pigs given no supplementary ration lost 13 gm per head per day. In order to obtain an increase of 1 kg. in live weight, 6 kg. of soya were required in the case of the animals fed on meadow clover, and 4.4 kg. and 4 kg. of soya respectively for those that were fed on irrigated meadow grass and the mixed pasture. Grazing therefore does not give satisfactory results with growing animals and sometimes causes a diminution in weight.

E. F

1341 - **Breeding Autumn Farrowed Pigs in the United States.** — CASEMENT, D. D. in *The Breeder's Gazette*, Vol LXXXI, No 10, pp 323-324 Chicago, March 9, 1922

On a Kansas farm, 72 sows were mated with boars of different breeds in May and March 1921

Twenty-one Duroc-Jersey sows (the number was subsequently reduced to 11 by sale) were served by 2 Duroc-Jersey boars, and 12 Poland China sows by 2 Poland China boars.

A third lot of 8 Duroc-Jersey and of Poland China were served by one White Large English Yorkshire boar, and one Duroc-Jersey sow was accidentally served by a Poland China boar

Fifteen sows (5 per lot) did not prove to be in pig. During June, July, and August, the sows were turned out to feed in a lucerne field and received a small maize ration. At the farrowing season, these animals were collected into several lots and placed in a field provided with sheds and sties, so that each sow could choose the shelter it preferred.

Between September 1 and October 3, 44 of the sows farrowed, the litter sired by the White Yorkshire boar was composed entirely of white piglings. The Duroc Jersey sows proved more prolific than the Poland China sows, and the sows of both breeds served by the white boar had larger litters than those mated with a boar of their own breed.

Out of 401 young pigs, 38 were born dead, the 363 others had decreased in number, by October 31, to 195, viz., 415 piglings per sow. This high rate of mortality is difficult to explain, for all the young animals appeared strong and vigorous ; it is however most probable that the sows were over-fat and the temperature was too high at the time of farrowing to obtain satisfactory results.

In many cases, the mothers proved bad nurses. The survivors however appeared more lively than usual and had excellent health. The piglings were inoculated with serum and vaccin after weaning, about December 13 ; on the same day, 73 of the largest animals, which already turn

(1) This is obtained by sowing per hectare : 2 kg *Phleum pratense* — 30 kg *Poa pratensis* — 2 kg *Poa trivialis* — 10 kg *Lolium perenne* — 8 kg white clover — 4 kg yellow clover.

ed the scale at 30 kg., were isolated and turned into an extensive grazing-ground.

The author is of opinion that it is too soon to make a satisfactory comparison between the following weights reached by the pigs of the different breeds at the date of the publication of this article.

Breed	No. of pigs	Weight in kg.	Age in days
Duroc-Jersey . . . . .	88	27.21	111
Poland-China . . . . .	16	23.68	94
Crossed with Yorkshire . . . . .	79	28.03	103
Hybrids Duroc-Jersey × Poland-China . . . . .	2	14.96	73

From these weights, no decision can be made as to the respective merits of any one race. The white pigs appear the heaviest, because they are the largest and fattest, but on comparing their age with their weight, it is seen that this is not a fair inference to draw. The superiority or inferiority of the white animals could only have been determined 100 days after the publication of this article viz., on April 15 (the probable date of their sale), at which time each pig would have weighed about 91 kg. The superiority of the white pigs as regards fertility and disease resistance is however clearly shown by the following Table.

Breed	Mortality at birth			Piglets that survived 105 days		
	Total births	Born dead	%	Pigs born alive	Alive on 105th day	%
Duroc-Jersey . . . . .	228	23	10.6	205	88	38.5
Poland-China . . . . .	34	11	20.0	43	16	29.6
Crossed with Yorkshire . . . . .	116	4	3.5	112	79	67.0
Totals . . . . .	398	38	—	360	183	—

The laws of hereditary transmission made it possible to predict that the mating of the thin spare Yorkshire boar with quieter and fatter sows would produce vigorous healthy offspring. Other experiments which are in progress will undoubtedly afford further proof of this superiority. E. F.

1342 - Development and Feeding of pure bred Yorkshire Pigs from the Time of Weaning to the Beginning of Fattening: Observations at the Lodi Experimental Cheese-making Institute. — FASCETTI, G. in *Annali dell'Istituto di Caseificio in Lodi*, Vol. I, No. 4, pp. 134-140. Lodi, September 1922.

The critical period in the feeding of pigs in establishments where it is based on whey, is that between the time of weaning and the beginning of

fattening. As a contribution to the knowledge of food rations which are suitable and of the increases in weights which occur during that period, the writer publishes the following data relating to the piggery attached to the Lodi Experimental Cheese-making Institute:—

AVERAGES FROM APRIL 30 TO JUNE 30.

Initial weight per head . . . . .	22.50 kg.
Daily ration per head:—	
Whey . . . . .	5.80 "
Indian meal . . . . .	0.25 "
Bran . . . . .	0.24 "
Average increase per head . . . . .	10.00 "

AVERAGES FROM JULY 1 TO AUGUST 30.

Initial weight per head . . . . .	32.50 "
Daily ration per head:—	
Whey . . . . .	9.50 "
Indian meal . . . . .	0.40 "
Bran . . . . .	0.40 "
Average increase per head . . . . .	17.80 "

I. D.

1343 — **A Bavarian Breed of Pigs in Process of Extinction.** — STOCKLAUSNER, in *Süddeutsche Landwirtschaftliche Tierzucht*, Year XVII, No. 9, p 101. Munich-Hanover, May 5, 1927.

The half red Bavarian "Landrasse" variety (local breed) was very common up to fifty years ago in Bavaria, in the north of the Palatinate; it was and still is known by the local name of "Triebsau". The animal had long legs and a large frame, it was excellent for extensive breeding, for it was accustomed to feed itself at pasture from spring to autumn. Its products were much in demand on the market. By the gradual substitution of intensive for extensive breeding this hardy race which developed slowly, had to give place to finer and more precocious races much less resistant to disease. To prevent its extinction a few specimens are now being reared separately in certain establishments and their crossing with selected pigs has given excellent results.

Experiments are being made on crossing with improved "Landrasse" pigs.

E. F.

1344 — **Studies of the present position of Pig Breeding in Germany and in Australia.** — I. MÜLLER, *Die deutsche Schweinezucht in Vergangenheit und Zukunft*, in *Deutsche landwirtschaftliche Tierzucht*, Year 26, No. 4, pp 35-36. Hanover, January 27, 1922. — II PERKINS, A. J., *The Pig Industry: A Neglected Source of National Wealth*, in *Department of Agriculture of South Australia, Bulletin* No. 161, pp. 2-20, II tables. Adelaide, July 1922.

I. — **PIG BREEDING IN GERMANY: PAST AND FUTURE.** — Before the war Germany owned 25 million pigs. The breeders fed their pigs in many ways: most of them had founded large industrial breeding establishments where the pigs were fattened quickly and either fed on German produce

(barley, potatoes, skim-milk) or else mainly on American maize and Russian barley. When the war broke out and the frontiers were closed against all imports, these establishments stopped work, for the country no longer furnished sufficient produce and none of sufficiently good quality; those who only used German produce were able to keep on their industry for a short time, but they also had to give it up on account of the scarcity of food and rationing. However, in spite of the difficult conditions created by the war, breeding was still possible on farms where the pigs fed on acorns in summer and were given large rations of turnips in winter and only consumed small quantities of foods rich in albumen (fish-meal, etc.). On the other hand owing to the gradual industrialisation of pig breeding this class of breeders was a small one and, consequently, the want of pork during the war and the reduction in its consumption became very marked and caused the number of pigs to fall to 5 millions. The number is now increasing daily and the increasing consumption of pork shows that the Germans cannot do without it even though the price is high. In fact, owing to the present cost of barley, 300 marks per quintal, a breeder cannot sell 1 quintal live weight of pork for which 5 qx. of barley are necessary, at less than 1700 marks. Increase in the production of pigs is impossible with such prices and in places where the industrial pre-war methods were followed agricultural methods have now to be substituted. This means increasing the period of fattening from 9 months to 1 year though the number of pigs required may be obtained in the course of time.

From spring to the end of autumn, and even in winter on fine days, the pigs live in the open and graze. As winter feed, tubers and roots are used. Turnips make one of the best feeds; next come potatoes, mangolds, swedes and carrots. The choice of these feeds is purely experimental on the part of the breeder, who knows that potatoes are best for fattening and turnips for rearing. These foods, rich in carbo-hydrates but poor in albumen should be mixed with others (beans, peas, lupines). Such products as fish-meal, blood-meal, etc. can also be used but in small quantities.

Sows suckling their young get turnips or potatoes and other very nutritious feeds so that they may lose as little weight as possible. The young pigs remain with the sow for 8 or 10 weeks. As from the 3rd week, they are fed with potatoes, fish-meal, crushed beans (without milk); they are then considered adult, go to graze in summer and are fed on turnips in winter. When the animal has reached a certain weight and age it is put to fatten and fed mainly on potatoes of which as much as it will eat are given. Boars and breeding sows kept for the purpose should be fed just sufficiently to prevent their losing weight; for this they should be turned out to graze in summer and given young dry clover and turnips in winter.

The commonest breeds of pigs in Germany are improved white pigs and improved "Landschweine" (pigs of the country).

The differences between the two races, owing to very extensive improvement, is small and is often merely a matter of the length and arrangement of the ears. For this reason the breeder should not let himself be influenced

too much by the question of breed in estimating the qualities of an animal nor when choosing an animal for breeding, consider only fine shape but also the number of teats, the fecundity of the sow and the rate of growth of the young pigs. Often the finest looking animals give a smaller quantity of lard, while the sows are not prolific and the boars do not breed well.

II. — THE BREEDING OF PIGS IN SOUTH AUSTRALIA AND ITS IMPORTANCE AS A SOURCE OF NATIONAL WEALTH. — In 1919, Australia owned 755 494 pigs, which was a decrease of 20 % as compared with 1900. In South Australia itself there were 60 000 pigs in 1919, while there were twice that number in 1890 and three times as many in 1884. This very considerable decrease indicates that pig breeding does not flourish in Australia at present. The bad health of pigs is a secondary and partial cause, but does not depend on the general climatic conditions of the country, which, on the contrary, are very favourable, nor on epidemic or sporadic diseases, which are rare and may easily be avoided if the animals are allowed to live in the open with as much room as possible and in strictly hygienic conditions. The main reasons are the carelessness and want of experience of the local breeders who do not know how to organise a favourable market for the export of their produce.

Such a market can only be found abroad, for local consumption is very limited, not more than 70 000 pigs a year, and is often an insufficient outlet for the production. To this must be added frequent and considerable fluctuations in prices, which are very risky for an industry such as pig breeding which requires a certainty of profit over a fairly long period. On the other hand there are at the present time special conditions which suggest pig breeding as the only resource for a large part of the national economy. Up to date cultivation in Australia has been on a 2 or 3 year rotation for a single crop, arranged somewhat as follows:—

	2 year rotation	3 year rotation
1st year	Fallow	Fallow
2nd "	Wheat	Wheat
3rd "	—	Grazing

This method was economically satisfactory so long as the land owned by the breeders could be extended and purchased cheaply ; but now conditions have changed, the area of estates goes on decreasing slowly but constantly and the cost of land steadily rises. A more intensive method of cultivation which will give 2 crops every 3 or 4 years is therefore imperative. But the growing of wheat after wheat cannot be recommended ; wheat must be grown alternately with another cereal, for example barley and preferentially Cape barley, oats, etc., so as to get the following rotations :— a) fallow — wheat — barley or oats ; b) fallow — wheat — barley or oats — grazing.

In Australia, there are at present about 100 000 acres of barley, of which the produce is difficult to distribute owing to the fluctuating conditions of the market.

If the above mentioned rotation is adopted there would then be about 1 000 000 acres under cultivation. The only way of utilizing the yield which otherwise could not be used, as the prices abroad, for example in England which imports largely, are insufficiently remunerative, would be to use it for feeding pigs. The writer describes some experiments made with the object of determining the conditions of rearing pigs on barley. These experiments gave the following results:— Twelve young pigs whose total weight was 620 lb. (about 51.67 lbs. each) were fed for 6 weeks so that they reached a weight of 1150 lb. (about 97 lb., each). During this period they were fed as follows:—

Crushed barley . . . . .	37.8 bus
Scraps of meat . . . . .	168 lb
Skim-milk . . . . .	924 lb.

This feeding caused an increase in weight of 534  $\frac{1}{2}$  lb.

Without reckoning the barley, the net cost was £1 8s. for the scraps of meat — 15s. 5d for the skim-milk — 18s for miscellaneous expenses — or a total of £3. 1s. 5d. The value of the increased live weight, taking pork at 8d. a lb. (the current rate at the time in the neighbourhood) was £17. 16s. 4d.; subtracting from that sum the previous total £3. 1s. 5d., there remains £14. 14s. 11d. for 37.8 bus. of barley, that is to say that each bushel of crushed barley brought in 7s. 10d when at that time the price of barley in the market was about 2s. the bushel. These conditions, in which breeding would be very profitable, are exceptionally favourable. At any rate, so long as the pork could be disposed of at a minimum price of 4d. per lb., breeding would always show a profit and the barley would thus be used to great advantage as a feed for pigs.

As has previously been stated, the local market could not absorb all the pigs which could be fed on barley produced on 1 000 000 acres; other markets must therefore be sought.

Great Britain is one of the countries where the importation of pigs is very important. In 1919, it imported 12 432 945 cwt. of pork worth £109 430 304 or 18.86d. per lb. and this item stood first among agricultural products, exceeding even wool in value. The price of 18.86d. per lb. is certainly remunerative for those who supply Great Britain; among the latter the United States comes first with 9 480 852 cwt., Canada next with 2 169 010 cwt., these quantities being worth £83 577 632 and £19 534 159 respectively. These figures show that 94 % of the produce of pig breeding consumed in Great Britain comes from regions where the agricultural conditions are, after all, very similar to those in Australia; and while in North America pigs are fattened on maize, in Australia they would be fattened on barley which gives a much better quality of lard. But in the United States there are 709 pigs per 1000 inhabitants; in Canada 470; in the Common-

wealth of Australia 141; and in South Australia only 129. There is, in short, the possibility of disposing of the surplus production of pigs of Australia in England and France, but this can only occur if the preparation and transport of the products has been previously assured. Despatch as frozen meat suggests itself as simplest but frozen pork only represents 13 % of the British import, which consists mainly of lard and hams. On the other hand the despatch of these two products is a difficult matter for the present, for Australian hams and lard are very different and often inferior in kind and quality to those to which European consumers are accustomed. Hence they could not compete successfully with the products of the United States, a country which has held for many years the European pig market and thoroughly understands the tastes and preferences of the consumers. The difficulties are partly due to the breeder, who does not breed the most suitable races, and partly to the butcher who is often careless in preparing the meat. However, if there were a demand at stable and remunerative prices the breeders of Australian pigs would certainly be impelled on their own account to improve production. According to the writer, experts familiar with the most up to date methods of breeding and specimens of the best breeds should be brought over from America, so as to enable large establishments to be started in which expenditure and loss would be reduced to a minimum. Private persons might with advantage interest themselves in such enterprises and Government assistance should be forthcoming.

E. F.

1345 - **New Methods of Pig Breeding in Germany as the most effective Means of Increasing Meat and Fat Production.** -- PROBST, in *Zeitschrift für Schweineezucht* Year XXIX, Nos 3-4, pp 33-37 and 49-57, figs 5 Neudamm, Februarv 15 March 1922

Pig-breeding could be made far more profitable than it is at present if the results of the most recent scientific experiments on the subject were applied to the industry. This remark holds good for Germany more than for any other country, since owing to the large number of swine reared and fattened there, a very large increase in meat and fat production could be obtained by avoiding common errors and getting rid of the negative factors neglected by practical breeders.

Very frequently, unprolific sows which are bad nurses are employed, fattening is carried out in an unsystematic fashion, and the animals live under unhygienic conditions, and are thus exposed to numerous diseases. Some of the piggeries are so badly built and kept as to exercise a deleterious effect on fattening and breeding. The boars are purchased in a haphazard manner, only the shape and size of the animals being taken into account without any guarantee as to their genetic qualities. The breeders usually do not keep a pig-book, or if kept, it is so incomplete as to be of little use. In order to correct these defects, the author advises that more scientific methods be adopted in the large establishments. It would, for instance, be necessary to collect, at these breeding stations, boars characterised by special qualities, and to cease breeding



from well-shaped, but unprolific sows. In the author's opinion three or four such stations, each possessing 20 brood-sows would be sufficient to distribute throughout Bavaria, directly or indirectly, a large number of animals for breeding purposes and considerably to improve the local production within the next ten years.

In systematic breeding no sow ought to be used that has any defect whether from the point of view of fertility or disposition, or which has proved a bad nurse. The boars chosen should be well-shaped, but must belong to a line known for its excellent and constant characters, thus giving the surest guarantee of their capability as sires. In order to start a breeding Station the young boars and sows must be the offspring of good sows, in which case some of the number will certainly make valuable breeding animals and probably produce progeny endowed with their own characters. By further selection it will be always possible to continue improving the quality of the breeding-stock.

In order to effect these reforms, a pig-book is absolutely necessary in large Stations, although to keep it properly requires much time and attention.

The author recommends a pig-book divided into 6 parts such as he suggested to the Bavarian Minister of Agriculture and describes its construction and method of use.

1) Register of the herds (in German *Herdbuchformblatt*). This is most important for the breeder, and shows at a glance the value and characters of the animal. Two pages are reserved for each individual. The number, name, date of birth, etc. are first entered, a space being reserved for the reasons of the animal's possible removal from the station. In another division is given the animal's pedigree to the 4th generation. On a separate part of the page are registered the following particulars: date of birth — number and weight of the newly born pigs — number, weight, growth, characteristic shapes of the young pigs reared — if the animal is a sow. If it is a boar, the number of sows it has served and the size of the litters are noted. In the case of each parent, the name, number, qualities and defects are registered. This modification in the usual tables is very useful, for the good or bad qualities of the animal's parents are at once seen; further, it is the only way of determining and demonstrating the laws of heredity in swine.

In another column are set down the length and quality of the different parts of the animal, to each of which a special number corresponds that marks its value. In systematic breeding establishments, no animal with a score lower than "very good" should be reared. The author regards as arbitrary the common practice of adding together the various points for the different parts of the body and considering their sum total as an index of the value of the pig.

On another part of the form are entered the number and shape of the teats, the weight of the sow and its length at different ages. The author recommends that the adult animal should be weighed and measured at least once a year.

2) Pedigree (*Ahnen tafel*). On this are entered the progenitors of each animal as far back as the 7th generation, with their good points and defects. It is an extended form of the table given in the Pig-book.

3) Album of photographs (*Lichtbildformblätter*). This contains the photos of the most valuable animals in the breeding-Station.

4) Pigling book (*Ferkelbuch*). In this are entered the characters and peculiarities of all the pigs farrowed every year by each sow.

5) Piggery-book (*Stallbuch*) a reproduction in pocket form of the first book. Compiled for the practical breeder.

6) Book of Weights (*Wagbuch*). In this are noted the weight of each pig in the breeding-station. Adult animals should be weighed four times yearly, while growing pigs must be weighed once a month.

7) Breeding Societies Register (*Aufnahmebuch*). This book is designed for Societies consisting of several breeders and gives in a reduced form the *Herdbuchformblatt* of each. E. F.

1346 - **The Expediency of Rearing Swine at Grass in South Germany.** — SCHNIDER, in *Zeitschrift für Schweinezucht*, Year XXIX, No 7, pp 97-100 Neudamm, April 15, 1922

One of the problems that German pig-breeders are now studying is how to feed their animals in order to obtain a reasonable profit in spite of the high price of food. One of the best possible methods is to turn the animals out to grass, a course that has been very generally advised. The author however is doubtful as to its expediency and makes reference to the fact that the pig-breeding conditions in North Germany are different from those obtaining in South Germany. In the north, there is a limited number of large industrial breeding farms as well as many average sized farms, and the grassland is either quite near or actually surrounds the homesteads. In such circumstances it is natural that the pigs should be allowed the run of the meadows, the doors of the sties are opened in the morning and left open throughout the day, so that the animals can come and go at will. On the other hand, whereas the large farms possess grass-land that is laid down and used periodically, there is no true pasturage in the smaller holdings, for as soon as the young grass appears in the spring, it is at once eaten.

The condition of affairs is totally different in South Germany (Wurtemberg, Grand Duchy of Baden etc.), where small and medium-sized farms predominate and pig-breeding presents many practical difficulties. The piggeries and farm-building are not isolated in the middle of meadows, but form part of the village, the fields possessed by each pig-breeder are scattered, and often lie far from the centre of habitation; the farmer has therefore not sufficient grazing ground for his swine. Turning his herds into the stubble fields would entail especially in the case of small holdings, the expense of a swine-herd to drive the animals from one field to another and the pigs would be obliged to walk long distances and this they could not stand as they belong to greatly improved breeds. For the above reasons, it is clear that grazing is not a suitable method for rearing pigs

in South Germany, at all events on small and average sized farms situated in villages. From the hygienic point of view, the animals do as well if left in the open yard all day as if they had the run of the fields. The author is of opinion that all idea of rapid fattening by means of very nourishing artificial foods should be abandoned and natural feeds used, although with these the pigs put on weight more slowly.

In conclusion, he impresses upon pig-breeders the paramount importance of the three factors: light, air and exercise.

E. F

1347 - **Lucerne as Pasture for Pigs, in Germany.** — FRÖHICH, in *Zeitschrift für Schweinezucht*, Year XXIX, No 6, pp 81-84, 1 fig, Neudamm, April 1, 1922

The general importance of lucern as a feed has always been recognised in Germany and the question of its particular utility as pasture for pigs deserves consideration.

The writer, after finding that the experiments on the subject hitherto made in Germany were insufficient, undertook a series of researches to ascertain if it were really profitable to utilize lucern in this way or not.

Twenty two young "Landrasse" sows, slightly modified by crossings with a superior breed, of a total weight of 1880 kg (average 85 kg. each) and a sow weighing 142 kg. were put out in a lucern field with four wooden sheds where they could graze for about 2-3 hours daily. As the lucern was already well grown the animals were allowed to graze for one morning only, the lucern was then cut, three days later the sows were again allowed to graze; grazing had to be suspended on two other mornings after the second and third mowings. The lucern was cut three times, it was found that the sows did not eat it so readily as before, perhaps because it had grown during very dry weather: the sows only ate the upper part and did not touch the lower, for this reason other freshly cut lucerne had to be given to them.

Eighteen animals remained on the pasture for 102 days, 5 from 63 to 70 days; there was an average increase of 122 gm. each per day. On the other hand in the case of 5 sows the increase in weight was very much less than for the others, the writer therefore recommends ascertaining whether the animals are profiting by the pasture by weighing them regularly and eliminating those which are not giving good results. In addition to the lucern eaten by the pigs the lucern field yielded 19 5 qx. of hay in the three mowings and the area of the pasture was such that it would certainly have yielded a total of 70 qx. of hay, equal to 175 or 200 qx. of green stuff; the daily ration of each sow was therefore 7.5-8 5 kg

In conclusion it may be stated that pasture has considerable food value; really lucern is one of the best foods for animals on account of its considerable albumen content, and they eat it readily, at any rate so long as it is not too old. Later on many of the sows littered and produced a considerable quantity of milk.

E. F.

[1346-1347]

1348 - Rape as a valuable Pasture for Pigs. — RICE, B. J. (Illinois Experiment Station), in *The Breeder's Gazette*, vol. LXXXI, No. 16, pp 329-350, 1 fig. Chicago, Ill., apr. 20, 1925

Rape is one of the best forage crops for pigs, and compares favourably with lucerne and young clover; results of analysis show that it contains 20-25 % of protein and has a high content in ash and a low content in cellulose. The full-grown crop is succulent and very acceptable to animals; in favourable conditions one acre of rape provides sufficient pasture for 12 to 20 pigs from June 1 to October or November. By sowing in April it is possible with care to feed six porkers; the June growth, if there is a slight rainfall, will feed the pigs during the summer months or in the early autumn, when the pigs who are now much larger, can eat a considerable quantity. Animals fed on a succulent nitrogenous crop such as rape in July, August and September fatten more quickly and the meat finds a ready market.

Both statistical and experimental results agree in demonstrating that rape is economically one of the best of pastures. During the experimental period at Illinois, pigs who were fed on maize and pastured on lucerne required for each increase of 110 lb in live weight about 6 ½ lb of maize more than the pigs who were fed on maize and pastured on rape. At the Purdue University pigs fed on rape put on 18 ounces of weight daily and those fed on clover only just over 1 lb and the quantity of supplementary feeding necessary in relation to increase in weight was less with the rape. The pastures used on the farms, which in 1916 and 1917 gave the best selling and most profitable pork, were clover, lucerne and rape.

Rape is not only useful as a pasture in summer and autumn but can also be sown with maize; it makes better growth when the maize is not too closely sown. The crop cannot entirely replace the nitrogenous feed, which is needed by maize-fed pigs, but can greatly reduce the requirement.

The use of rape has the disadvantage that the leaves are so heavy that the dew is not evaporated before noon; hence the young pigs get wet and may contract illness through exposure to the sun's rays. However it is always possible not to put the young pigs to pasture in the morning and to give them instead a dose of oil. E. F.

1349 - Pig-Breeding in Tuscany: its Difficulties and the Means of Promoting its Development (1) — PERGOLA, V., *Der fattori ostacolanti lo sviluppo dell'industria del maiale in Toscana, Relazione presentata all'XI Congresso degli Allevatori di bestiame della regione toscana, tenuto in Grosseto il 21 e 22 Maggio 1922*, 11 pp Florence, 1922.

In Tuscany it is possible and also economical to turn pigs out into the fields and allow them to feed on the grass throughout the year, as the winters are mild, and there are no prolonged droughts to destroy vegetation. As a matter of fact however except in the wooded districts, the healthy method of rearing swine in the open is not practised and the pig-breeding industry does not develop as it should. The author has investigated the causes of this failure and summarises them as follows: 1) prejudice on the

(1) See: R. August 1921, No. 842; R. September 1921, No. 939. (Ed)

part of the peasant who believes that pigs must either roam at will, or else be always shut up in the sty ; 2) the prevalence of infectious diseases ; 3) lack of uniformity in production ; 4) unsuitable feeding, especially in the case of young pigs ; 5) defective piggeries ; 6) want of cooperation among breeders.

Rearing pigs on the lucerne field costs less than letting them feed in the woods, provided the earliest-maturing and heaviest breeds are kept and they are given supplementary rations of concentrates and minerals. Selected breeds thus fed are no more resistant to disease than ordinary pigs.

The author agrees with Prof. FINZI, of the *Scuola Superiore Veterinaria* at Turin, viz., that swine-fever is only fatal when attended by complications which can be avoided by giving the animals an aperient, keeping them on a liquid diet and well-protected from the cold.

The stock now in Tuscany consists of a great variety of breeds : local Blacks, "Cintas", Middle Whites, Large Whites, and Large Blacks, together with innumerable ranges of admixture between them. A great step in advance would be made if it were possible to replace all these varieties by a single homogeneous race.

The "Cinta" is a thrifty, strong, fairly early maturing large animal and a good walker. It is especially suitable for rearing in the woods. As farm animals, the author advocates the hybrids resulting from the industrial (first generation) cross between the Large Black sow and the Large White boar (1), for they inherit the valuable qualities of both breeds and are much prized on the markets. The author also emphasizes the necessity of making separate boxes for nursing sows and of adopting self-feeders and automatic drinking bionghs.

F. D.

POULTRY  
REARING

1350 - The Effect of Cod-Liver Oil on "Leg Weakness" in newly-hatched Chickens. — HART, E. B., HALPIN, J. G., and STEINBOCK, H., in *The Journal of Biological Chemistry*, Vol. III, No. 2, pp. 379-386. Baltimore, June 1922.

Fifty-seven Rhode Island Red chicks were divided into 3 lots of 19 each and shut up in small enclosures strewn with wood-shavings. The first lot received a daily ration of 97 parts wheat, 2 parts carbonate of lime and 1 part sodium chloride plus skim milk *ad lib.* The second lot were fed the same ration and given in addition 50 gm. cod-liver oil per kg. of feed ; the birds took the oil mixed with the food without any apparent repugnance. The third lot which served as the control, received a very varied ration composed for the most part of wheat, oats and bran.

Of the 19 chicks forming the first lot, one died before it was a fortnight old, 6 died within 6 weeks and 8 within 8 weeks ; 5 were killed for purposes of analyses. The plumage was ruffled and the birds showed a tendency to squat on the ground and other signs of leg-weakness.

All the birds of the second lot survived ; they remained strong and active and were recognised as normal by expert breeders. At the end of

(1) This method has been adopted with success in Ireland and in England : See R. July 1922, No. 750 ; R. August 1922, No. 859. (Ed.)

4 weeks, 5 individuals were removed from lot 1, and 5 from lot 2 in order to determine the phosphorus content of their blood. The results obtained are given in Table I.

TABLE I — *Phosphorus content per 100 cub cm of serum in lots I and II*

Lots I and II				Lot II			
Number	Lot I Age in weeks	Weight	Phosphorus	Number	Age in weeks	Weight	Phosphorus
10	4	105gm	1.93 mgm	25	4	100gm	2.50 mgm
11	4	95	1.07	26	4	145	5.15
16	4	115	2.80	27	4	90	2.73
17	4	120	1.40	34	4	120	3.80
18	4	120	1.73	37	4	120	3.80
Totals	—	555gm	8.93 mgm	—	—	575gm	17.98mgm

The uniformity of the results obtained in the case of the chicks of lot II prove the beneficial effects of the vitamin in cod-liver oil, in the same manner, the figures of Table I show that, except in the case of No. 16 the phosphorus content of the blood was much higher in lot II. The authors do not explicitly state that rachitis and leg-weakness are the same for they are still awaiting the results of further experiment, but they regard two facts as significant: a) cod-liver oil has a specific action on both rachitis and leg-weakness; b) the phosphorus content (which decreases in rachitic subjects), also fell in chicks suffering from 'leg-weakness'.

Six birds (weighing 200 gm) were taken one after the other from the third lot and fed like those of the first. They grew normally for 3-5 weeks following the change of diet, but afterwards lost flesh and the characteristic symptoms of leg-weakness made their appearance, the plumage became ruffled, and the chicks crouched on the ground. After 4 weeks of the new diet, 3 birds (Nos. 39 — 40 — 41) were killed in order to determine the phosphorus content of their blood, Nos. 42 — 43 — 44 being killed successively for the same purpose. The results are given in Table II.

TABLE II — *Successive Weights and Phosphorus Content of Serum in Lot II*

Number	Weight at time of change of diet	Weight 2 weeks later	Weight 4 weeks later	Weight 6 weeks later	Phosphorus per 100 cm <sup>3</sup> of serum
39	300 gm	470 gm	390 gm	—	2.41 mgm
40	230	410	400	—	1.59
41	250	460	450	—	2.41
42	245	390	485	470 gm	3.75
43	220	330	440	430	3.70
44	220	340	445	435	2.80

The phosphorus content clearly tends to fall, which is in complete agreement with the results obtained from the first lot. There are however variations which may be attributed to errors in the method of phosphorus determination (that of MARRIOTT and HAESLER), or to the excessive shortness of the period during which the chicks were kept in the ration without oil.

The author concludes by stating that newly-hatched chicks can be reared on a ration consisting of wheat, skim milk and small amounts of salts, provided a considerable quantity of cod-liver oil be added during the time of most active growth. The efficacy of cod-liver oil is due to the vitamins it contains, the vitamins B and C being probably supplied by the wheat and skim milk (1).

E. F.

1351 - **The "Type" in Poultry Breeding.** — PROVINZALE, F., in *Allevamenti*, Year III, No 8, pp 204-307 Palermo, August 25, 1922

In poultry breeding, as in other kinds of breeding an exact valuation of the characters which differentiate one race from another is necessary if crossings are to be effective and give products specially adapted for the object proposed. The writer groups the innumerable races of domestic fowls under 3 types. The first group (brachymorphous) is suited for table purposes and consequently its secondary sexual characters are slightly developed; in shape it is substantial and it has a marked aptitude for fattening. The second group (dolichomorphous) is used for egg production, its secondary sexual characters are highly developed: the hen is agile, robust, energetic, wiry. The third group (mesomorphous) is used for both purposes, its shapes are more harmonious and intermediate.

The writer states that the type is the only natural method of grouping the different races, the only method on which regular breeding and rational crossing methods can be based.

E. F.

(1) It might perhaps be well to refer here to the principal foods in which the presence or absence of vitamins have so far been determined. According to HARDY (Vitamins and the Food Supply, in *Journal of the Society of Chemical Industry*, Vol 40, No 5, pp. 70-82, London, March, 13, 1921), vitamin A (soluble in fatty substances) is found in: animal fats — fish-liver oils — green vegetables — yolk of egg — milk and butter — oleomargarine. The insufficiency of vitamin produces rachitis, a checking and sometimes stoppage of growth, keratomalacia. Vitamins are absent from most vegetable oils, white bread, margarine, purified proteins and carbohydrates.

The vitamin B (antineuritic) is found in seeds (especially in the embryo, pericarp and aleurone layer), in yeast, and yolk of egg; it is wanting in white bread, polished rice, fats, egg albumin, and purified proteins and carbohydrates. Its absence causes a checking and sometimes a stoppage of growth, beri-beri and the polyneuritis of birds and rats.

Vitamin C (antiscorbutic, or water-soluble) is present in green vegetables (especially the Cruciferae) orange and lemon juice, tomatoes, germinating seeds and in carrots. It is absent from seeds, white bread, fats, yeast, and purified carbohydrates and proteins; shortage or absence causes scurvy. (Ed.)

**1352 - Intensive Chicken Rearing.** — PLIMMER, R. H. A., ROSEDALE, J. I., TOPPING, R. B., CRICHTON, A., I The Vitamin Requirements, Preliminary Experiment. — II. The Effect of "Good" Protein, in *The Biochemical Journal*, Vol. XVI, No. 1, pp. 11-22. London, 1922.

I. — Poultry-breeders usually consider that chicks cannot live normally under artificial conditions of housing and feeding, consequently they regard life in the open, access to grass and freedom of movement as indispensable to success in rearing the birds. Several investigators have however tried to keep a chicken in the laboratory; had their experiment succeeded, it would have been of great importance from the practical standpoint. So far, however, the results obtained have been far from satisfactory and the greater number of the workers attribute their failure to lack of, or a wrong method of supplying vitamins.

In order to decide the question, the authors undertook these experiments and succeeded in keeping several chicks in normal conditions of health, from July 13, 1920 to February 28, 1921, by feeding them exclusively on dry oat meal, a little milk and cod-liver oil containing the vitamin A, some autolysed yeast with the vitamin B, and lemon-juice with the vitamin C. The birds were found to show marked susceptibility to an insufficient amount of vitamin B. The amount of this vitamin required by the organism appears to increase in proportion to the increase in fats and carbohydrates and may be represented by 0.5 gm. of yeast per 30 gm. of flour, and 5 cm<sup>3</sup> of oil (for 11 birds), while 5 cm<sup>3</sup> of vitamin A and 30 cm<sup>3</sup> of lemon juice (vitamin C) daily is enough for 11 chicks. It should be noted that these are not the minimum figures, for since the vitamin requirements of poultry are unknown, the total amount given had to be determined in an arbitrary manner. Later experiments may be able to fix the minimum quantity of each vitamin. Out of 24 chicks, 12 reached maturity, one died as the result of accident, another succumbed at the beginning of the experiment, while a third fell a victim to fowl cholera.

At the end of August 1920, many of the birds suffered from weakness of the legs, but were soon cured by increasing the dose of the vitamin B, whereas an increase in vitamin C was without any effect.

II. — This second series of experiments was undertaken to confirm the results of the first, which appeared to prove that chicks could be reared in the laboratory, provided a sufficient quantity of the three vitamins were added to their rations, and to test the effect of "good" proteins on growth. Choice was made of a mixture of lactalbumin and caseinogen, both substances containing a large amount of lysin, with the required quantities of vitamins added. The protein brought about rapid growth; the cockerels began to crow when 40 days old, and the pullets laid their first egg at the age of 139 days. The cockerels weighed 1834 gm. and the pullets 1815 gm. The birds moulted quickly during October and their health was always good. It is an interesting fact that the beaks and legs of individuals thus fed were not pigmented. The yellow coloration of these parts of the body is derived from yellow pigments in the food which were entirely lacking in the experimental ration. E. F.



1353 - **Piscicultural Value of a Stream.** — JOLYET, A., in *Revue des Eaux et Forêts*, Vol. LX, No. 9, pp. 283-296. Paris, Sept. 1922.

PISCICULTURE

The author gives the results of important experiments carried out by the University of Grenoble under the superintendence of Prof. LÉGER (1). They relate to:— Hydrologic considerations — Nature of the banks and bottom — Surrounding flora — Qualities of the water — Nutritive resources — Causes of destruction. The author also gives an account of some researches made by himself.

**HYDROLOGIC CONSIDERATIONS.** — The stream to be studied should first of all be divided into "sections", that is to say portions small enough to be sufficiently homogeneous. For the study of the hydrologic regulation the following should be noted:— 1) the width of the stream — 2) its depth; average depth; existence of shoals, which may be useful as spawning places, and holes (very deep places) where carp may take refuge for wintering and where trout like to stay when they leave the portion of the river containing salmonidæ and venture down stream into the portion containing cyprinidæ — 3) seasonal variations in depth — 4) the volume and speed of the flow and their seasonal variations: — floods and low condition of the stream are specially injurious if they happen during the spawning season.

**NATURE OF THE BANKS AND BOTTOM.** — The following should be noted:— slope of the banks, on which depends their suitability as spawning places) — petrographic nature of the banks and the bottom — colour of the bottom — whether it is strewn with scattered rocks or not, etc.

**SURROUNDING FLORA** — 1) *Riverside flora.* — Vegetation on the banks forming a screen shelters the water against the heating action of sunshine, this may be advantageous, by maintaining a suitable temperature for salmonidæ, but is not an advantage when cyprinidæ are concerned as their fry often require very warm water. It may also shelter the stream from wind and supply insects which, blown into the water by the wind, form a considerable part of the food of fish. It should therefore be noted whether the stream runs through a forest, a meadow, cultivated or uncultivated land; whether the banks are bare, turfed or wooded, etc.

2) *Aquatic flora.* — This flora can serve as food for the fish, directly in the case of a herbivorous species, indirectly by the animals which it harbours, in the case of all species. Lastly it is often useful for the spawn. Plants which branch most under water are the most useful, both because they harbour a greater number of animals such as worms, molluscs, crustacea and larvæ of insects and because they serve to support the spawn. From this point of view, water-cress, the water Ranunculus (preferred by pike for the deposit of its ova), etc. are very useful. On the other hand, plants with thick sub-aqueous stiff, unbranched stalks (reeds, reedmace, etc.) are "cumbersome" from a piscicultural point of view.

(1) *Travaux du Laboratoire de Pisciculture de l'Université de Grenoble*, 1909 and following years. Grenoble, Allier Frères, Edité. (Author's note)

### QUALITIES OF THE WATER. — I. Physical qualities: —

1) *Temperature* — The mean annual temperature is of less interest than seasonal variations. It is specially important to note the periods during which the water reaches the temperatures required for the spawn of the principal kinds of fish:— 10° (perch, rudd); 13° (Prussian carp, pike); 17° (bream, roach, tench); 20° (carp).

On the other hand, the mean temperature during the 3 hottest months (June, July, August) and the usual maxima during that period should be noted. These high temperatures, as a matter of fact, influence the descent of the salmonidæ down stream in the rivers, as they influence the mortality among lampreys and shad after spawning. Further, local variations must be taken into account:— the "holes", where the water remains cool in summer, and bottom springs attract large trout and salmon going down to the sea.

2) *Limpidity*. — It is important to note whether the water is usually muddy or limpid, whether the periods of muddiness are frequent and whether they coincide with the spawning seasons. Even when not poisonous, matter in suspension is injurious to fish because it is deposited wherever the current slackens: these deposits cover the supports in the spawning places, hindering the fish from depositing their ova. They even cover the ova after spawning and hinder their hatching out. Finally the fish may have their respiration impeded by an actual obstruction of their gills: saw-dust especially may thus cause death by suffocation.

3) *Colour*. — To judge the colour, the water is examined in a test tube holding about 1 litre, placed on a sheet of white paper and compared with distilled water in a similar test tube.

II. CHEMICAL PROPERTIES. — These can only be determined by a series of chemical analyses. Certain indications however enable a rapid, though rough, estimate to be made.

### *Quality of water in relation to its fauna and flora.*

Quality of the water (1)	Fauna	Flora
Pure . . . . .	<i>Physa fontinalis</i> . . . . .	Watercress.
Indifferent . .	Pond snail . . . . .	<i>Potamogeton natans</i> .
	Oval pond snail . . . . .	<i>Veronica anagallis</i> .
	<i>Planorbis marginata</i> . . . . .	<i>Veronica Beccabunga</i> .
Unhealthy . .	Red Cycas . . . . .	Waterlily.
	<i>Bithinia impura</i> . . . . .	Rushes. Dock. Loosestrife.

(1) This relates to the quality from the point of view of potability by man, but it should be similar for fish.

1) *Smell and taste.* — Water which gives off a putrid smell and water which has a disagreeable taste or which is even simply flat, may be considered *a priori* as indifferent or bad.

2) *Fauna and flora.* — The annexed Table is copied from the book :— P. F. CHALON, *Les eaux souterraines*, Paris and Liège, 1913, Libr. polytechnique.

3) *Aeration.* — A sufficiently aerated water should give off bubbles of gas as soon as it is placed on the fire in a thin metal vessel.

4) *Hydrotimetric degree.* — The nationality of the scale used must be indicated :— 1 degree on the French scale is equivalent to 0.56 of a degree on the German scale or 0.70 on the English scale.

5) *Percentage of organic matter.* — This is of interest because this matter is liable to undergo putrid fermentation, setting free deleterious gases.

FOOD RESERVES. — The production of young fish will not increase the number beyond that which the supply of food will support. These reserves are essentially of an animal nature and consist mainly of the lower animals. Among these aquatic invertebrate animals which probably serve as food for fish are :— all the Entomostraca (the lowest subclass of the Crustaceæ), which are sought after by young fish — Worms (*Lumbriculus*, *Rhabdoceles*, *Tubifex*, *Trichodrilus*, *Nais*, etc.) — Amphipoda Crustacea or fresh water shrimps belonging mainly to the genus *Gammarus* — Insects :— larvæ of Perlidæ, Ephemeridæ, Phygadeionidæ, Chironomidæ, etc., "water spiders" (*Berris*, *Velia*, etc.) — Molluscs. It appears from M. LÉGER's researches that to give one of the Salmonidæ the quality of flesh called "Salmon flesh" it is sufficient to feed it abundantly with shrimps.

The larvæ of Perlidæ live more especially in the streams containing Salmonidæ.

M. LÉGER observes that in the list of Invertebræ found in the stream under examination it is specially desirable to note those which are "dominant", that is to say the species which are particularly abundant during the three hot months.— June, July and August, the fish feeding season. Land insects which fall into the water, or which are blown into it by the wind, or which, flying along the surface of the water, may be snapped up, form a considerable part of the food of the fish.

CAUSES OF DESTRUCTION. — Very numerous, especially for the ova :— infectious diseases, poisonings, poaching, destructive animals

From an examination of all data relating to the piscicultural value of a stream it is possible to deduce the "biogenetic capacity", that is to say the number of fish of such and such a species that the stream can normally harbour so as to produce fully. This idea comes in when it is a case of deciding :— 1) a reasonable number of young fish to put out in a stream ; 2) the quantity of fish that may be caught.

To reduce the biogenetic capacity to figures, M. LÉGER suggests that a numerical value, in a scale running from 0 to 10, should be given to a stream.

A stream which only contains 15 to 20 cubic cm. of nutritive matter per sq. m. of bottom or per cubic m. of water may be considered poor. Very rich water contains 10 times as much or more.

Streams whose bottoms are constantly shifting, but have here and there a more stable pebbly bottom, where layers of diatoms, chlorophyceæ, mosses, etc. are formed and where consequently a few scanty larvae of insects (Ephemeridæ or Perlidæ) are found can be valued numerically by 2 or 3, often more.

If the bottom of the stream is fixed and formed of rocks or large irremovable blocks of stone, the flora and fauna are richer and the biogenetic capacity may be as high as 3 to 5.

If the streams are less rapid, with tufts of aquatic plants here and there alternating with sand banks or have a rocky bottom harbouring a numerous fauna of larvæ of insects and crustacea, the biogenetic capacity rises to 5 or 7 and may reach 9 if there are also quiet parts sheltering shoals of small fish e. g. minnows or loaches.

Lastly the richest streams are those which, winding about in fertile plains, have a regular, moderate current, slowed down here and there and whose bottoms are largely carpeted with the aquatic plants previously referred to or with large pebbles covered with Fontinalis and algæ in which swarm various aquatic fauna. Their numerical value, seldom less than 8, may reach the maximum if very favourable conditions of exogenetic alluvium, determined by crops or by the river-side vegetation, are added to the inherent nutritive richness of the stream.

The biogenetic capacity remains approximately constant over a width of from 2 to 25 m. along each bank of the stream, but beyond that it decreases rapidly. If the stream is over 5 m. in average width, it must be taken into account in calculating the biogenetic capacity.

The *population formula* (N), expresses the number of fish which the stream should normally contain per kilometre of length; the *yield formula* (K), the quantity (in kg.) of fish which may be caught during a year per km. of length. These formulæ are respectively:—

$$N = 10 \beta (L + 5); \quad K = \frac{\beta (L + 5)}{2}$$

where L represents the average width of the stream and  $\beta$  the biogenetic capacity numerically valued from 0 to 10. F. D.

1354 — **Advantages of Keeping Carp in Ricefields for Fertilizing the Soil.** — CHIAPPELLO, R., in *Il Giornale di Piscicoltura*, Vol. XII, No. 9, p. 144. Vercelli, September 30, 1922

On an area of 17 831 sq. m., with a total expenditure of 1681 lire for feeding, introduction of the Galician "mirror" carp, *Cyprinus carpio* var *specularis*, superintendence and miscellaneous expenses, M. TAGLIABUE, at Morimondo (Province of Milan), has succeeded in getting a profit of 819.25 lire, after deducting expenses, corresponding to 450.45 lire per ha. (1)

(1) See R. Apr. 1921, No. 422 (Ed.)

To this profit should be added the advantages resulting from the decreased cost of removing grass and manuring and from the increased yield of rice. Moreover, the wheat which followed the rice gave a more abundant crop in the place where intensive rearing of carp was practised. The plot gave 23 qx of paddy and 34 qx. of straw per ha. as against 17 and 21 respectively in the control plot. Keeping carp has therefore clearly a favourable action on the fertilization of the soil.

F. D.

1355 - **Piscicultural Research in Germany.** — *Zeitschrift für Fischeri und deren Hilfswissenschaften*, Neue Folge, vol V, No 1-2, pp 205, 8 full page pl Berlin, 1922

The number reviewed contains the following papers:— 1) TORLITZ, Contribution to the question of the species of the common river eel, anatomo-biological research, with a bibliography of 40 publications, — P. SCHIEMENZ, Research work on the feeding of aquatic animals and especially of fish — 3) A. WILLER, Research work on the feeding of lower aquatic animals; the feeding of *Gammarus pulex* — 4) P. BROFELDT, winter feeding of the perch and the ruffe (*Acerina cernua*) — 5) E. DOBERS, Research work on the feeding of fish in natural conditions.

BROFELDT concludes from his experiments that the perch and the ruffe feed also in winter, though less than in summer. The smallest perch (up to 10 cm. in length) feed on Entomostraca, those a little larger (from 10 to 12 cm) feed on land animals, the largest probably only feed on fish. *Asellus* is the most important of the land animals; the larvae of *Chironomus* and worms of the genus *Tubifex* are also important, other land-dwelling animals are of negligible importance in the feeding of perch.

The smallest ruffes (up to 6-8 cm.) feed on Entomostraca and larger kinds of land-dwelling animals, especially larvæ of *Chironomus* and the isopod crustacea *Asellus*.

DOBERS made his experiments from July to October. The stomach contents of various species of fish are given in 8 large Tables and the whole is summed up in a 9th Table, from which the following facts may be deduced:—

Out of the 4 species examined, young fish and *Corixa* were only found in the perch (*Perca fluviatilis*).

Ephemera were only found as from September, during September in the perch only; during October in all 4 species; they were most important for the perch; least important for the roach (*Leuciscus rutilus*).

*Chironomus* forms the principal food of the perch and the ruffe (*Acerina cernua*), from July to October, they are of much less importance for yearling tench (*Tinca tinca*) and for roach.

Perfect insects (taken on the surface of the water):— of some importance for roach, in one case only, in July.

Chydorides (except the genus *Eurycercus*):— of some importance in October, for tench only.

*Eurycercus*: — important in the feeding of perch and ruffes in July-August.

*Daphnia*, *Ceriodaphnia* :— important for perch in July-August.

*Bosmina* : — very important for roach in September ; not unimportant for roach and perch in July-August.

*Gammarus* :— more frequently found, during October, in ruffles than in the 3 other species examined.

*Algæ* :— found only in roach, in October, in two ponds, but in them of fundamental importance.

A comparison of the feeding of these species, commonly called and erroneously, herbivorous ("grünweide") with that of carp proved that they are formidable competitors and that consequently their presence is not desirable in ponds where carp are kept. The least serious competitor is the tench ; as a matter of fact tench and carp are often kept together.

A smaller number of examinations were made of "sandra" (pike-perch) (*Lucioperca Sandra*), gudgeon (*Gobio flumiatilis*), three spined sticklebacks (*Gasterosteus aculeatus*), bream (*Abramis brama*) and young fish, most of them probably roach.

The following were found :— in the pike-perch, larvae of Chironomus in the gudgeon Chydorides, remains of Cladocerae and larvae of Chironomus ; in the ruffe, larvae of Chironomus, Copepodes and, in smaller numbers, Ephemera (this fish is therefore a dangerous competitor with the species bred which have greater value) ; in the bream and in young fish, mainly Cladocerae and some Chydorides and Daphnia.

F. D.

1356 — **Eels and their Place of Breeding** (1). — SCHMIDT, J, in *Philosophical Transactions of the Royal Society of London*, Series B, Vol 211, pp. 179-208, pl 17-18 London, April 1922

After reviewing previous experiments on the biology of the eel since 1904, the writer describes the results obtained in 1920-1921, on board the schooner "Dana" On these results and on the whole of the previous experimental work, M. SCHMIDT bases his reasons for reconstructing the sexual life of the eel as follows :—

During the autumn months, European eels (*Anguilla vulgaris*), which have reached the stage of "silvery eel," migrate to the Atlantic ocean and travel towards the south-west : the direction of their journey, the duration of which is still unknown, is towards a part of the western Atlantic situated to the north-east and north of the West Indies between 22° and 30° N. latitude and 48° and 65° W longitude. The central portion of the region is about 26° N and, consequently, about mid-way between the Leeward islands and the Bermudas. Here the eels breed ; spawning starts at the beginning of spring and lasts until the summer. At first the larvae, from 7 to 15 mm. in length, remain at a depth of from 200 to 300 m. and grow rapidly ; they reach 25 mm. in the early summer months—they then move towards the surface of the ocean and, helped by the move-

(1) See R. 1919, No. 1213. (Ed.)

ment of the mass of water towards the west, they begin their journey in the direction of the coast of Europe. During the first summer they are found as far as 50° W; the second summer, they grow to 50 or 55 mm. and get as far as the Central Atlantic; finally, in the third summer, they reach the limit of their growth (75 cm.) and gain the coastal waters of Europe.

During the autumn and winter they undergo the metamorphosis described by GRASSI and CALANDRUCCIO and pass from the leaf shaped stage to the blind stage.

SCHMIDT often found larvae of the American eel (*Anguilla rostrata*) mixed with those of *A. vulgaris* in the place of breeding; the migration of the two species in opposite directions might be due to two causes:—  
a) the one ethnological, the larval stage of *A. rostrata* only lasting one year the period being consequently insufficient for crossing the Atlantic, b) the second geographical, the centre of the breeding place of *A. rostrata* being slightly more to the west and south than that of *A. vulgaris*. E. F.

### FARM ENGINEERING.

1357 — Development of Electro-Agriculture in the Province of Bologna. — I Z, in *Agricoltura Bolognese*, Year XII, No 4, p. 39, 8 figs Bologna, April 15, 1922

AGRICULTURAL  
MACHINERY

The writer, taking as his standpoint the report of A. TARCHETTI on certain trials made at the Vercelli Competition and leaving out of account heavy oil machines, observes that the funicular tractors most used in electric ploughing are the HOWARD fixed motor type, with horizontal cylinder motor on the carriage itself or on a separate carriage, and the FOWLER mobile motor type, which works along the edge of the field. After referring to the great advance made in this kind of mechanical ploughing through the efforts of the "Ape" Society, the writer gives a practical demonstration to prove that such systems should be adopted as advantageous from an economic point of view

Indeed, by using steam or internal combustion motors for ploughing, the cost per ha. fluctuates between 400 and 500 lire, whereas with electric power, at the contract prices of the Company, the maximum price is 385 lire, made up as follows:

Hire of the apparatus complete, including the services of a foreman, provided by the Company . . . . .	300 lire
5 workmen provided by the user . . . . .	75
Transport of the apparatus complete . . . . .	10
<b>Total . . . . .</b>	<b>385 lire</b>

As to the work performed by these machines, the writer gives the following figures, taken in actual practice: in 10 hours, with a single furrow plough, in dry soil, and at a depth of 35 to 45 cm., 6 to 7 sections are ploughed; with a double furrow, and at a depth of 20 to 30 cm., 8 to 10 sections are ploughed. In a rice field, with a single furrow 20 to 25 cm. deep, 9 to 10 sections (of 2080.44 m<sup>2</sup>) are ploughed.

Each complete machine-set includes a portable enclosed apparatus for transforming the electric current (15 000 to 220 volts), a horizontal-cylinder carriage, an electric-motor carriage, a plough balance and two anchor carriages with metal cable systems which, when attached to the cylinders, give the forward and backward movement to the plough.

G. D.

**1358 - Palm Oil as Motor Fuel.** — DAUTREBANDE, J, in *Revue de Chimie Industrielle*, Vol. XXXI, No. 369, pp 268-269. Paris, September 1922.

Palm oil is derived from the pulp of the fruit of the palm ; it is composed of palmitin, olein, glycerine, with palmitic, stearic, oleic acid ; it melts at 35°, burns at 200° ; its calorific value is 9228 calories. The supply of palms is immense all over the African continent ; and the natives utilize only a tenth part. In 1912, 108 000 tons of oil were exported, including 78 000 tons from Nigeria. It gives an excellent fuel, leaving no residue ; it is possible to reach a temperature of 1800° and there is no risk of exploding owing to its high flash point. Transport is easy on account of its butyrous consistency ; its acidity does not corrode metals ; its unit price is less than that of other fuels in its country of origin ; 1 kg. of palm oil is equivalent to 1.200 kg. of coal. The only drawback, compared with crude oil, already largely used, is the high flashing point, which makes it difficult to light. Motors of 120 HP. are already working successfully with palm oil and it may be predicted that its use will soon become general.

A. de B.

**1359 - Experiments in Mechanical Flax Carding.** — PASSELEGUE, G., in *Journal d'Agriculture pratique*, Year 86, Nos 31, 34, 35, pp. 113-114 ; 117-178 ; 195-197 ; 2 figs Paris, August 5, 26, September 2, 1922.

Three types of machines for mechanical carding were entered at the last competition held at the Wallelot-sous-Beaumont industrial experiment Centre. The writer refers to the economic and industrial value of this system and describes in detail the three types of machines, which may briefly be classified as :—

Type for carding	with combs
" " "	" rollers
" " "	" belts

with some modifications made by each maker. The programme of the competition prescribed the output, its quality, cost of carding, time taken, the cost of the machine and its amortization, as compared with similar standards on an equal quantity of raw material carded by hand. The writer concludes that whatever the decision of the judges may be, which will no doubt be very interesting, the fact remains very encouraging from the point of view of the development of machine work in agricultural industries.

G. D.



1360 — **Farm Garages.** — RINGFLMANN, M., in *Journal d'Agriculture pratique*, Year 86, No. 30, pp 94-99, 5 figs. Paris, July 29, 1922

The writer describes all the qualities which should be found in garages intended for housing touring cars and small camions intended for agricultural use. He then gives detailed information on the subject of the dimensions suitable for country garages and he considers the case of a building constructed to hold a single vehicle, indicating the slight modifications which would be required in the original plan to adapt it to the requirements of several vehicles.

When building a garage in the country, the question of economy of space does not enter as is the case in towns, and the writer therefore recommends the following dimensions for a building to house a single vehicle —

Total length of the building :— length of the vehicle + 2.40 m.

Total width of the building — width of the vehicle + 2 m.

The writer remarks that the width may be slightly decreased if several vehicles arranged side by side are to be housed. In fact, if the given dimensions were applied in the case of several vehicles, there would be 2 m. free space between each pair of vehicles, which might be reduced to 1.40 m. Thus, supposing a touring car is about 4.20 m. in length with a width of 1.60 m., or that a small camion occupies a space of 5 m.  $\times$  2 m., and applying the dimensions of the former case, a garage 6.60 m. in length by 3.60 m. in width would be required.

It is recommended that the window and the entrance door should be on the same side as the front and rear of the vehicle.

The door should be at least 2.50 m. wide and about the same height, and if possible a sliding panel or falling panel door should be used. It should be so arranged that the vehicle enters the garage on one side and goes out by the exit door opposite. There should also be sufficient free space round the garage for entry and exit movement ; this space should be 7 to 8 m. wide.

Regarding the height and architecture of the building, the writer leaves it to the taste of the builder, provided he tries, as far as possible, to make the building harmonise with the surroundings, having due regard to the importance both of such harmony and of economy of material used.

G. D.

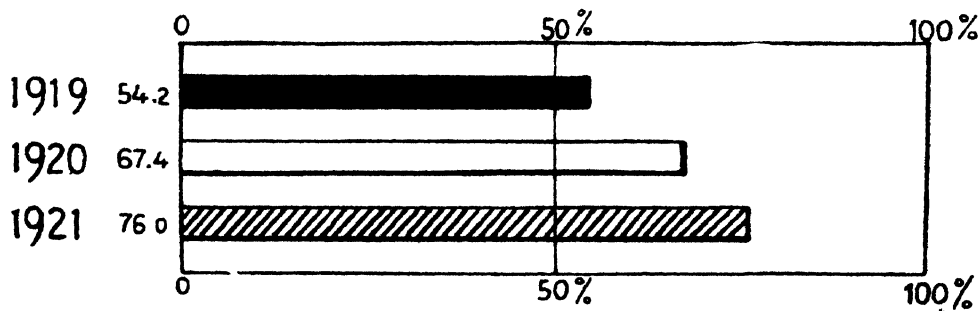
## RURAL ECONOMICS.

1361 — **Value of Animal Products in Relation to Crop Yield since 1919 in the United States.** — *Weather, Crops and Markets*, Vol. II, No. 11, pp 220-221. Washington, D. C., Sept. 1922.

Under the normal price conditions of 1911-1913 the value of the animal products of the farm, including animals raised, was 59.7 % of the value of crops. By 1916 this value had decreased to 48.1 % and by 1917 to 43.4 %. Thereafter the ratio of the value of animal products to crops increased to 56.9 % in 1918, fell to 54.2 % in 1919, increased to 67.4 % in 1920, and to 76.0 % in 1921. As the value of animal products decreased

between 1911-1913 and 1917 in relation to the value of crops, the value of crops in terms of animal products relatively increased from 167.4 % in 1911-1913 to 230.3 % in 1917.

The reason for these opposite tendencies was to be found in the fact that prices of crops increased under war conditions, before the United States became a participant, in a greater degree than the prices of animal products. After 1917, crops in relation to animal products lost in total value and in 1918 and 1919 were but little above their pre-war relative position. In 1920 the steep decline in the prices of crops gave to crop value the abnormally low position of 148.3 % relative to the value of animal products, because the prices of animal products were not so sensitive to the deflation movement as were the prices of crops. The prices of primary products, such as crops, are usually more sensitive to general influences than are the



Value of Animal Products as a Percentage of the Value of Crops, United States, 1919-1922

prices of secondary products, such as animal products, which depend on crops for their production. The relative position of crop values declined in 1921 to 131.6 % of the value of animal products, the lowest point in the record of the U. S. Department of Agriculture which extends back to 1897.

The crop year beginning in 1919 included the peak of the price inflation movement which extended into the calendar year 1920. From 1914 up to and including the crop year 1919, the value of animal products in relation to the value of crops fell, and yet even in 1919 the value of the animal products of the farm was greater than the value of the crop production in 6 States. By 1921 crop prices had fallen so much further relatively than the prices of animal products that the list was expanded to 11 States by the addition of prominent crop producing States.

The change in Iowa's relative position from 1919 to 1921 is worthy of note. In 1919 its crop value was \$811 200 000 and the value of its animal products \$745 000 000, but in 1921 the crop value had fallen to \$282 600 000 while the value of animal products had fallen to \$475 700 00. The relative values of crops and animal products in Iowa shifted from an excess crop value of \$66 200 000 in 1919 to an excess value of animal pro-

ducts of \$ 193 100 000 in 1921. The value of animal products as a percentage of the value of crops in Iowa increased from 91.8 % in 1919 to 129.2 % in 1920 and to 168.3 % in 1921, whereas in the United States the movement was from 54.2 % in 1919 to 67.4 % in 1920 and to 76.0 % in 1921.

Computations similar to these have been made for 8 prominent crop producing States, the value of whose animal products on farms exceeded the crop value in 1921. G. A. B.

1362 - **Plant Foods and human Foods in Germany.** — LEMMERMAN, O., in *Zeitschrift für Pflanzenernährung und Düngung*, Vol 1, No 1, pp 3-8 Leipzig, 1922

Before the war, Germany produced 90 % of the vegetable elements and 67 % of the animal products . fat, meat, milk etc., which she required. German agriculture sufficed therefore for the feeding of 56 million inhabitants, and the remaining 12 million were supplied through importation, which was then very easy. The loss of 73,000 sq km., or 13 6 % of her territory, has deprived Germany of :

19 7 % of her potato crops  
17 20 % of her barley crops

13 72 % of her rye crops  
12 60 % of her wheat crops

On the other hand, the population has diminished by 7 5 millions, or 10 8 % . Formerly there were 192 inhabitants per 100 ha. of arable land ; at present there are 202. Larger importation is therefore necessary, a very serious problem under present conditions. Production therefore must be increased, and this can be effected by the following means : culture and intensified improvement of soils — proper increase of manuring — development of plantations — selection of appropriate species — selection of seedlings — control of weeds — increase and improvement of forage — etc., but the most important questions are those connected with plant and animal diseases.

During the 25 years of peace from 1889-1890 to 1913, the yield per ha in Germany had increased as follows :

Bread cereals, 58 %.  
Animal feed cereals, 52 %.  
Potatoes, 56 %  
Rye from 11.8 to 19 qx. per ha.  
Wheat from 15 1 to 23 qx per ha.  
Oats from 14.1 to 21.9 qx per ha.  
Potatoes from 101 8 to 158.6 qx per ha.

The consumption of fertilisers rose from 16.2 million qx. in 1880 to 106.9 millions in 1913, an increase of 600 %. But the war has caused a great decrease. Nitrogen, from 635 000 tons consumed in 1913 of which 185 000 were artificial fertilisers, had fallen in 1919 to 305 000 tons, of which 115 000 were artificial. Phosphoric acid, from 1 060 000 tons, of which 550 000 were fertilisers, in 1913, had fallen as low as 430 000 tons in 1919, of which 230 000 tons were fertilisers.

Consequently, the yield per ha. has decreased as follows :

Bread cereals	from 18 39 to 14 4 qx per ha or 46 3 %
Forage cereals	" 19 3 " 15 0 " " " 24 22 %
Potatoes	" 142 0 " 98 0 " " " 31 %

During the last 25 years (1885/89, 1908/12), food production had increased as follows

Cereals	from 16 3 million tons to 26 million tons	.	.	46 3 %
Potatoes	from 29 7 million tons to 44 2 million tons	.	.	48 9 %

At the same time, the increase in the population, which rose from 48 to 64 millions (300 000 yearly) was inferior by 33% to that of food production

In order to be completely independent of importation, Germany should increase her production by 50 %. According to MAYER, the maximum possible yield per ha. is as follows

40 qx of wheat and straw
320 qx of potatoes, including tops
300 qx of beets, including tops

Further, there are still 3 5 million ha of uncultivated land which could easily be rendered arable by artificial fertilisers A. de B.

## AGRICULTURAL INDUSTRIES.

1363 - **Types of Wine produced in the Trentino** — CATONI, G and GUSELORRO, A, in *Giornale vinicolo italiano*, Year 48, No 11, pp 102-103 Casale-Monferrato, March 12, 1923

### AGRICULTURAL INDUSTRIES

The common red table wines, as sold, are the result of mixing various wines. They differ in character even in the same district. Two principal types can be distinguished:— wine made from "Pavara" and "Marzemino Padovano" or "Negrone" grapes, which is full-bodied but slightly acid and peculiar to the Val d'Adige, in the Rovereto zone, and that which is made from "Schiavone" or "Fossaro" grapes to which "Toroldico" or "Negrara" grapes have been added, which give an agreeable bouquet; it is produced in the zone to the north of Trent.

The white table wines are mainly made from the "Vernaccia" and "Bianchetta" varieties. They have relatively little body and are defi-

(1) See *R* March 1921, No 302; *R* July, 1921, No 728; *R* October 1921, No 1012, in which the above-mentioned vines are described. For other information regarding the Trentino wine-making industry, see — GRAMATICA, L'industria enologica e i vini della Venezia tridentina, in *Bollettino del Consiglio provinciale d'Agricoltura*, Year XXXV, No 7-8, pp 189 192, April 15-20, 1922; Dati analitici dei vini della Venezia Tridantina dell'ultimo ventennio, *Ibidem*, pp 193-195; PANIZZA, T, Della produzione e del commercio vinicolo nel Trentino *Ibidem*, pp 196-204 (Ed)

ent in alcohol, but they have a pleasant flavour and are stimulant and smooth to the palate. "Riesling Italico", if it comes from favourably situated places, also enjoys a certain reputation in the market.

The better table wines are called "special wines". For the white kind, "Nosiola" and "Garganera" grapes are used; for the red wine, "Negrara", which in some places also furnishes a bottling wine. "Groppello" is also superior to the ordinary wines. But the wines of the Province most in request are "Marzemino" and "Teroldico". The former is alcoholic, delicate and slightly scented; the latter has a strong bouquet with a special aroma and a high alcoholic strength; it is rich in colouring matter and does very well as a wine for mixing and for bottling.

In the Sarca Valley (Dro), "Trebbiano" gives a scented wine of the Marsala kind, which is called "vino santo". From the "Nosiola" grape of the neighbourhood of lake Toblino and of the Pressano and Sorni (Lavis) hills an excellent wine called "natalino" or "vino santo" is made by the straw process. "Rhenish Riesling," "Traminer," "Bourgogne," "Cabernet," etc. from the Trentino are all excellent wines which are equal to the best vintages. The chemical composition of the principal wines mentioned is given in the following Table:—

*Chemical composition of the principal Trentino wines.*

Variety	Alcohol	Acidity	Acetic acid	Dry extract without sugar	Ash
	% of volume				
Grammues per litre					
Red table wine (Rovereto zone) . . . . .	8.89	5.92	0.70	19.27	2.31
Red table wine (Mezolombardo zone) . . . . .	9.25	6.20	0.60	19.00	2.20
White " Vernaccia " . . . . .	8.90	6.52	0.79	16.00	1.50
" Riesling Italico " . . . . .	10.00	5.22	0.97	21.13	2.74
" Nosiola " . . . . .	10.93	5.40	0.64	16.32	1.52
" Groppello " . . . . .	18.64	9.24	0.26	23.54	2.74
" Negrara " . . . . .	11.71	5.40	0.62	20.27	2.09
" Marzemino " . . . . .	12.64	5.04	0.58	20.78	2.14
" Teroldico " . . . . .	12.47	6.00	0.72	22.61	2.22
" Vino santo " . . . . .	14.17	7.52	0.99	145.80 (total)	2.40

F. D.

1364 — The "Deferrage" of Wines (Report of the Governor General of Algeria). — POUGET, (Professeur à la Faculté des Sciences, Directeur du Laboratoire de Chimie agricole et industrielle, Alger) and BONNIER (Chimiste attaché au dit Laboratoire), in *Bulletin Agricole de l'Algérie, Tunisie-Maroc*, 2nd Series, Year 25, No. 2, pp. 33-43. Algiers, February, 1922.

Certain wines are known to show turbidity on exposure to the air, and this alteration is called *casse*. If these wines are poured from one vessel into another or left in an open receptacle they sooner or later become

thick. This has been found to occur especially with white wines; these become colourless, turn milky and finally deposit a dirty white precipitate. In the case of red wines, the pigment is almost always precipitated, an iridescent film first appears on the surface, then the liquid becomes completely turbid, and after some hours, quite a large quantity may have become "*cassé*". The colouring matter becomes insoluble and turns more or less brown and floats upon an almost colourless liquid; later it falls to the bottom where it forms a purple precipitate. The other constituents of the wine also become altered and the vinous flavour disappears.

Two kinds of *casse*, the oxydasic and ferric are recognised. The former is due to the presence of soluble oxydasing ferments that introduce oxygen into the colouring matter, thus altering it so that it precipitates. This was discovered as long ago as 1894 by BOUFFARD who also suggested the means of remedying this trouble. The wine must be heated to 65° C., or else sulphur dioxide or bisulphites added, to render the oxydase inactive. At the present time the addition of sulphur dioxide and of its salts is general, and hence this wine disease no longer occurs. Ferric *casse* is much more serious; it also was reported by BOUFFARD, but somewhat earlier, viz., in 1887. He found the deposit contained as much as 10 % of iron (determined as ferrous-ferric oxides), and showed that the introduction of a ferrous salt is enough to cause a tendency in any wine to become turbid. BOUFFARD recognised that this disease is not checked by means sufficient to destroy the oxidase; heating is wholly ineffective and sulphur dioxide only succeeds in checking the alteration until it assumes considerable proportions. Tartaric acid however stops the change and masks the iron reaction. These statements were confirmed by LAGATU who persuaded the experts to adopt his opinion.

As FONZES-DIACON has shown, the white precipitate is almost entirely composed of basic ferric phosphate associated with a small amount of basic calcic phosphate and containing colouring matters. It is clear that the ferrous salts are oxidised by the air and transformed into ferric salts which combine with the phosphoric acid and precipitate it; the precipitate carries with it any foreign matters present. In red wines, the ferric salts can also react on the colouring matters.

The researches of A. GAUTIER have proved that these colouring substances are tannoids, i. e., compounds possessing the properties of tannin which can be divided into three groups: 1) a yellow pigment, very resistant to oxidation — 2) red pigments, or *œnolins*, some of which are soluble and others insoluble in water — 3) violet pigments, or *œnocyanins*, that appear to be ferric salts ionisable by œnolins or their amino-derivatives. *œnocyanins* occur largely in the black grapes of hot regions; in the presence of air, the ferrous ion becomes ferric by oxidation which causes precipitation of the tannoid substance. This is one of the causes of the clearness of old wines and of the instability of thick wines; it also bring about *casse bleue* or the blackening of wines. *œnocyanins* are however frequently not present in many red wines and in all white wines and in these cases, *casse blanche* occurs. The grapes used for making

these wines contain iron, but this only occurs in traces, or in the form of non ionised organic combinations, and thus has no power of reaction. The iron found in the white precipitate of these wines must undoubtedly have been introduced during the manufacturing process, it is derived from the iron used in wine-making plant, vats, beaters, pressers, pipes, etc. The acid of the must and wine attack the iron, the sulphur dioxide is still more active, especially if it is present in considerable quantities; 6-10 gm. per hectolitre should be sufficient, especially if the wine is also cooled if necessary. In order however to dispense with the refrigeration process, larger quantities are introduced with the result that the solvent power of the iron is increased and "*casse*" insues Bisulphides, particularly sodium bisulphide, have a similar effect when used instead of sulphur dioxide. Owing to the presence of phosphates in the wine, most of the dissolved iron is precipitated as ferric phosphate. Wine should normally not contain more than 100-300 mgm of phosphoric acid per litre, but now-a-days, ammonium phosphate is added to the must to promote alcoholic fermentation, as much as over 30 gm per hectolitre being sometimes introduced; the results of this addition which encourages *casse blanche* (a milky appearance), have been reported by FONZES DIACON

In order to prevent this form of *casse*, some wine-growers have limited or suppressed the use of iron or cast-iron apparatus and have adopted glazed ware receptacles

Another way of attaining the same result consists in the introduction of organic acids that dissolve the basic ferric phosphate and thus mask its presence.

BOUFFARD recommended for this purpose the addition of tartaric acid, sometimes in considerable amounts up to 500 gm. per hectolitre, but this process is no longer permitted Citric acid may be used, which is even more effective, provided the dose be sufficient, but as the French regulations limit the amount to 50 gm per hectolitre, the wines continue to become turbid.

A few unscrupulous dealers use a mixture of gelatine and ferrocyanide of potassium which possesses the property of precipitating the ferrous and ferric salts in the form of Prussian blue, which is afterwards removed by filtration, but in the presence of the organic salts of wine, this reaction is not complete. As fast as the organic acids become oxidised, the rest of the Prussian blue goes on precipitating, especially if the pseudo-clearifying agent is employed to excess. Blending with another wine also gives rise to *casse bleue*. It should also be observed that owing to the unstable nature of ferrocyanide, hydrocyanic acid may be produced, so that this treatment is dangerous

Excellent results have however been obtained by the GRANDCHAMP-MALVEZIN method. This consists in introducing oxygen into the wine by means of a Chamberland filter under a pressure of 4 atmospheres. The oxygen makes tiny bubbles forming a true emulsion which lasts from 2 to 3 days. The ferrous salts in this wine which is supersaturated with very finely-divided oxygen, become oxidised and are precipitated in the

form of ferric salts. All the precipitate settles if the wine is left undisturbed for three weeks, or it can be clarified quickly with gelatine. In the case of white wines, it is necessary also to add tannin; in red wines, the oxygen transforms the various tannoids into tannin. Apparatus is now made that allows several vats to be treated simultaneously. The treatment is simple and neither troublesome nor offensive, and has the additional merit of being economical. The amount of oxygen used is 1 m<sup>3</sup> per 200 hectolitres, and the present price in Algiers is 5 frs per 100 hectolitres. The analyses made by the authors have show that the greater part of the iron is removed by this method. Thus the iron content of a wine rich in iron fell from 52.5 to 29.5 mgm. per litre. In certain cases it is necessary to repeat the treatment. L. V.

1365 - **Studies on Wine Mould and Mouldiness in Cellars in Italy.** — CIPERRI, R., in *Rivista di Ampelografia*, Year III, No. 1, pp. 1-5; No. 2, pp. 17-22; No. 3, pp. 32-39; No. 4, pp. 49-54. Alba-Ivorno, January-April, 1922.

There is very little literature on cellar mould and such as there is deals mainly with means of preventing it. The writer was therefore induced to undertake an experimental study of the subject including determination and count of cryptogams living in cellars, attempts to grow these moulds in wines and musts, under varied conditions, until the agents producing the mouldiness were identified by classifying their different odours, and, at the same time, experiments in an inverse direction to isolate the agents causing bad condition in wines, an examination of the conditions of the mouldiness, methods for treating affected wines.

By exposing Petri capsules to the air of the cellars, transplanting wood and cellar-wall cryptogams direct and then transplanting them to meat broth and agar in succession, the writer isolated: *Penicillium crustaceum* (L.) Fries (= *P. glaucum* Link.) — *P. roseum* Link. — *P. humicola* Oudem. — *Trichoderma lignorum* (Tode) Harz. — *Verticillium glaucum* Bonord. — *V. lateritium* Berk. — *Sterigmatocystis nigra* v. Thiegh. — *Spicaria elegans* (Corda) Harz. — *Aspergillus virens* Link. — *Trichothecium roseum* Link. — *T. candidum* — *Oospora nivea* (Fuck) Sacc. and Vogl. — *Cladosporium herbarum* (Pers.) Link. — *Coniosporium phaeospermum* (Corda) Sacc. — *Torula monilioides* Corda var. *globosa* Ferraris — *Helminthosporium obclavatum* Sacc. — *Stachybotrys alternans* Bonord. — *Epicoccum vulgare* Corda — *Rhizopus nigricans* Ehrenberg. — *Mucor mucedo* L. — *Rhacodium cellare* Pers. — *Ozonium lignorum* Fic.

While in the open air, the capsules being placed on the windows of the cellars, the number of the bacteria is more than double that of the fungi, in the cellars the fungi are more than twice as numerous as the bacteria. The maximum number of fungi is found where work is carried on; in a busy place, the number of micro-organisms is 7-9 times greater than in quiet places.

The characteristic odour of mould is communicated to the wines by an Actinomycete isolated by the writer both from the air and from mouldy wine. It does not seem completely to coincide with any of the species



hitherto described, and the writer proposes to give it, for the time being, the name of *Streptothrix* (*Actinomyces*) *Sanninii* n. sp. It lives on the wood of the casks and if placed in contact with the wine or must, it does not develop, either because of the content in acidity or alcohol, or because it necessarily requires air for existence. As its odoriferous principle is much more soluble in alcohol than in water, the finer and more alcoholic the wine is, the sooner does it assume the mouldy smell and flavour.

Prof. SANNINO (*Trattato completo di enologia*, Turin, 1920, Vol. II, pp. 217 and sq.), distinguishes 4 different mould odours: 1) odour and taste of real mould; this is the most frequent and is treated with olive oil; 2) the "sapore di tempesta", which is both a mouldy odour and a very disagreeable flavour, at once styptic and bitter, attributed to the *Penicillium crustaceum*; the specific treatment is a fresh fermentation; 3) sour taste imparted to the wine through contact with staves attacked by mould and damp, which requires to be treated by a new fermentation; 4) dry taste; to be treated both by a new fermentation and by oil.

The first type of mouldy odour is generally attributed to the *Penicillium*; the writer's experiments are said to prove that this is a mistake, because this type is produced by the *Streptothrix Sanninii*, which he has isolated.

As means of prevention rinse the barrel with wine after first washing with water and close immediately afterwards; or wash with sulphurated wine; or sulphurate the barrel. Means of cure. treat the wine pure with olive oil (1 %). Arachis, cottonseed and sweet almond oils may, as the writer has observed, also be used for the same purpose, provided they are well purified, colza and rapeseed oils give rather good results; soy oil takes off the odour but not the mouldy taste; castor oil and raw or boiled linseed oil take off the odour but leave traces of their sickly flavour. In this respect, purified vaseline oil (colourless) is superior to all others; a treatment with as little as 0.5 % is sufficient; after use, if an emulsion is made with water, or alcohol, in which it is insoluble, the mouldy smell passes into the alcohol and the oil may be used again. On the other hand vaseline oils coloured artificially with aniline dyes should never be employed (1).

F. D.

1366 — Process of fermenting Maize Stalks for making Acetone, Alcohol and volatile Acids. — PETERSEN, W. H., FRED, F. B. and VERHULST, J. H., (Department of Agricultural Chemistry and Agricultural Bacteriology, University of Wisconsin), in *Journal of Industrial and Engineering Chemistry*, Vol. 13, No. 9, pp. 757-759 September, 1921.

The writers describe some fermentation experiments, made with *Bacillus acetoethylicum*, on a syrup of maize stalks, obtained by hydrolysis. The principal products obtained with this bacillus are acetone, ethylic alcohol, formic acid, acetic acid and carbonic acid gas.

(1) See R. February 1921, No 199. (Ed)

The biochemical relations between these products are very intimate ; with a large production of acetone and alcohol there is a small yield of volatile acids, while with a large production of acids, the yield of acetone and alcohol is very small. These variations in the yield of products are caused by the reaction of the solution :— an alkaline reaction favours the production of acids, while an acid reaction favours the formation of alcohol and acetone. The writers prepared the fermentation solution by hydrolysing the stalks with dilute sulphuric acid. After hydrolysis they neutralized the excess acid with lime water. The insoluble residue is compressed and washed several times so as to extract as much sugar as possible from it.

The production of sugar capable of fermentation (composed mainly of xylose) depends on the quantity of acids, the volume of water, the duration of heating and on the pressure exerted during hydrolysis. The greatest yield of sugar (25-30 %) was obtained by heating for about 1 hour, under a pressure of 1.35 atmospheres, stalks mixed with 4 times their weight of water and with 8 % of their weight of acid.

The writers next made numerous experiments to determine which are the best conditions for bringing about the fermentation of the sugary solution, obtained by the hydrolysis of the stalks.

They began by preliminary experiments made in test tubes ; they next made several series of fermentations in glass globes of about 1 litre capacity.

The fermentation was carefully followed and the fermentation solution was subjected to continual and close analysis.

From the analyses made it was concluded that an almost complete fermentation (90 % of sugar transformed) was obtained in a receptacle partly filled with coarse coal cinders.

The bacteria adhered well to these cinders, so that the whole culture was well distributed. By drawing off the fermented solution, at the end of fermentation, and by replacing it by fresh solution, taking great care not to disturb the layer of bacteria, the writers obtained a continuous and rapid fermentation.

In this process of fermentation, one of the most important points which has to be considered is the reaction of the medium. The acidity should be continually controlled and corrected when necessary with carbonate of lime. This neutralizes the excess of acidity which is produced during fermentation. By working in the best conditions, the writers obtained the following yield :— out of 100 parts by weight of stalks, they got 2.7 % by weight of acetone, 6.8 % by weight of alcohol and 3.4 % by weight of volatile acids.

In conclusion these experiments have shown that maize stalks can be used as raw material for the production of acetone, ethyl alcohol, and formic and acetic acids. The syrup obtained by the hydrolysis of maize stalks by means of dilute sulphuric acid, which contains mainly xylose, was rapidly and almost completely fermented by *Bacillus acetoethylicum* and gave the products named above.

L. M.

1367. — **Possibilities of the Plant Growth of the damp Tropical Areas for Supplying Materials for Liquid Fuel.** — WHITFORD H. N (Yale School of Forestry, Yale University, New Haven, Conn.) in the *Journal of Industrial and Engineering Chemistry*, Vol. XIV, No. 2 pp. 151-152. Washington, D. C., Feb. 1, 1922.

The future scarcity of the United States liquid fuel supply is now so apparent that the question of its early replacement has become a vital problem in national economics. A question involving the annual synthesis of some 4 900 000 000 gallons of a feasible gasoline substitute calls for the development of new ideas and new sources of energy. The one great source of energy is undoubtedly the sun and the question how can this source best be utilized arises. The obvious answer is to be seen in the growth of plant life from which, in turn, alcohol and other fuels may be made. The object of WHITFORD's article is to consider the possibilities of the tropics as a source of transformed solar energy capable of being utilized for the production of liquid fuel.

**WOOD CROPS.** — The raw material which is most abundant as a product of the energy of the sun is wood and the moist regions of all tropical countries still contain vast areas covered with virgin forests. Only in the tropics is growth so rapid that enormous crops of wood could be raised in a short time, in order that quantities of wood sufficient to supply a large alcohol-producing plant could be grown on a small area. Theoretically the moist tropics should have a double or even higher capacity to produce a given quantity of cellulose in a given time than temperate regions. This is actually the case in practice. Measurements of certain species of average hardwoods in the tropics indicate that they grow from three to five times as rapidly as such woods as cottonwood and white birch in United States climates. One acre of ground in the tropics can be made to yield as much timber in a given time as five or more acres in temperate regions, and, other things being equal, the cost of assembling this raw material at the factory would be greatly reduced.

**BAMBOO CROPS.** — Measurement made in the Philippines show that culms of certain species of bamboo will attain a height of from 66 to 82 feet in a single season ; most of the growth takes place during three months. Two to three years are required for the culms to harden. Unfortunately little or nothing is known concerning the areas of bamboo in the tropics. In the eastern tropics it is found in pure stands or mixed with hardwoods over vast areas, while in the western tropics it is of very limited occurrence (1).

To depend on bamboo for paper pulp or for alcohol, planted crops must be raised. A rough estimate of the cost of bringing them to maturity (5 years) is about \$26 pr acre, but when once established and properly managed such plantings could be made to yield crops indefinitely. The yield per acre might perhaps be doubled and the acreage reduced one-half by selecting larger species. It is of interest that in the Philippines alone

(1) See R. 1922, No. 60. (Ed.)

TABLE I. — *Yield from small sized bamboo forests in the Philippines.*

Average yield per acre of dry material . . . . .	14 long tons
Average yield per acre of pulp . . . . .	3 short tons
Estimated average yield per acre of alcohol at 40 gallons to ton of pulp . . . . .	280 gal.
Acreage necessary to produce heat equivalent to 1920 production of gasoline in United States . . . . .	27,000,060 (42,200 sq. m.)
Amount of alcohol from this area . . . . .	7,500,000,000 gal.
Acreage necessary on 3 years' rotation . . . . .	87,000,990 (126,600 sq. m.)
Average cost of raw material per gallon of alcohol . . . . .	\$ .3 = 1/3

there are some 68 000 square miles of cut-over waste lands in grass and second growth forests that might be made available.

NIPA PALM. — While alcohol can be obtained from the inflorescence stalk of many palms, the nipa seems to be best adapted for its commercial production.

TABLE II. — *Yield and Cost of Alcohol from Nipa Palm.*

750 plants per ha. that can produce sap
43 litres of sap per plant per season
32,250 litres of sap per ha.
65 per cent. of sap alcohol.
2096 litres of alcohol per ha. = about 210 gallons of alcohol per acre
Cost of raw material per gallon of alcohol, 12 cents.

The annual production of nipa alcohol in the Philippines is nearly 3 000 000 gallons and only a small part of the entire area is under production, part of which is planted. The largest continuous area of nipa palm in the Philippines is about 22 000 acres.

No data are available for the total acreage. Much more extensive areas are known to exist in Borneo and part of the mangrove swamps of the tidewater throughout the Indo-Malay region. To make up the equivalent of 5 000 000 000 gallons of gasoline produced in the United States in 1920 would require an area of more than 50 000 square miles. If all the tidal swamps of the Indo-Malay tropics were planted with nipa the area available would probably fall far short of this.

WILD GRASSES. — About 40 per cent (48 000 square miles) of the de-forested area of the Philippines is covered with two wild grasses, viz « cogon » (*Imperata exaltata*), known in other parts of the Malay region as « langland grass » and « talahib » (*Saccharum spontaneum*). Experiments indicate that these grasses especially « cogon », compare very favorably with esparto grass in regard to yield of pulp, averaging about 45 per cent by the soda process. The « cogon » is a grass 5 or 6 feet in height and is found in the drier soils, while « talahib », found in the damper soils, reaches a height of 9 to 10 feet. In some parts these grasses could be made to yield

two crops per year. Unfortunately, no figures are available for their average acre yield.

In other parts of the tropics there are large areas covered with grasses that might be suitable for paper making and possibly alcohol, among which may be mentioned the « caña brava » (*Cynerium sagittatum*), a large bamboo-like grass found throughout the moist tropical region of America. It is cultivated in many parts especially Columbia and Venezuela, for construction purposes.

AGRICULTURAL CROPS. — Reliable average statistics concerning the cultivation in tropical regions of strictly staple agricultural crops are not available. The figures given below are therefore subject to correction as additional information becomes known.

It is the author's opinion that of all agricultural crops cassava is one of the most promising to investigate for the production of immense quantities of alcohol, since with improved methods of cultivation the yield per acre could undoubtedly be considerably increased

TABLE III — *Cost and yields of cassava*

Yield per acre of roots	10 tons
Cost of raw material per ton	5 \$
Per ton yield of alcohol	30 gal
Per acre yield of alcohol	300 gal
Cost of raw material per gallon of alcohol	16 <sup>2</sup> / <sub>3</sub> cts
Acreage necessary to raise the equivalent of the 1920 production of alcohol in U S	
(about 40 000 sq m)	27 000 000

*Maize* is extensively grown in the tropics but only exported to a slight extent.

Possibly two crops per year might be raised with a production of 40 bushels; the same amount of maize would be raised in the tropics as in the United States, on an area one-half the size. This high rate of production would seem somewhat problematic in view of various adverse factors.

In the tropics the *rice* crop usually takes four to five months to mature. Where the rainfall is sufficient it can be grown without irrigation. It is probable that if the proper amount of soil moisture could be had, say by irrigation, two crops per year could be obtained.

While *cotton* is of tropical origin, most of the world's production comes from the North Temperate region. Continuous rainfall and much cloud is detrimental to the growth of cotton; hence very moist tropical regions are not suited to its production. In regions subject to drought irrigation is necessary. While there are many extensive regions in the drier parts of the tropics that could be made to yield larger amounts than they are now doing, it is probable that the production per acre in the tropics cannot be increased over that of the best portions of the United States cotton belt.

*Sugar cane* is essentially a perennial crop. Black strap molasses from refining sugar is the present source of most of the United States industrial alcohol.

The above is an incomplete review of the possibilities of the tropics to produce crops of foodstuffs and wood capable of application to the manufacture of cellulose and alcohol. Little or nothing is known of the possibilities of many of the wild forest products for the manufacture of pulp suitable for paper making, or the amount of alcohol that they will yield by distillation or by fermentation processes. Until the fast growing species suitable for these purposes are found it is useless to talk about producing them on a large scale. The few figures given serve merely to indicate the possibilities and are based on admittedly limited data.

The evidence, however, is conclusive that the tropical sun has the power to store up more energy in the form of cellulose in a given time than the temperate sun, and if this energy is in a utilizable form it is left to human ingenuity to overcome the difficulties of finding the means for its profitable application.

G. A. B.

**1368 — The Sweetness of Cane and Beet Sugars and their Value for Jam Making. —**

OGILVIE, J. P., in *Chemical Industry*, Vol. XI, I, No. 16, pp. 343-345. London, August 31, 1922.

At present there are in the market two qualities of cane and beet sugar:— 1) refined sugars; 2) unrefined sugars. The former are obtained by dissolving crude sugars a second time and by treating them with animal charcoal to purify them and finally letting them recrystallize. The sugar so obtained is formed of saccharose almost chemically pure (99.95 %) and it is difficult to determine the impurities which it contains. Derivation from cane or beetroot makes no difference in the sweetness of the sugar or in its value for making jam. Unrefined sugars are obtained by filtering the syrup and by washing it with water and steam in centrifuging apparatus. The best unrefined sugars contain 99.5 % of saccharose. The difference between refined and unrefined sugars consists in the presence of reducing sugars, ash and non-sugary organic substances. Unrefined sugars derived from the sugarcane have a slightly acid reaction. They contain reducing sugars and have an agreeable smell derived from the syrup. Sugars derived from beetroot do not contain any reducing sugars and are often slightly alkaline. Sugars of inferior quality may retain the disagreeable odour which is characteristic of beetroot syrup.

Many merchants and physiologists think that cane sugar, though containing the same percentage of saccharose as beet sugar, or even less, is sweeter than beet sugar. The writer explains the difference by the fact that the sensation of sweetness, felt by certain nerves, is affected by the sensations of acidity, alkalinity, etc. which are felt simultaneously by other nerves. Thus traces of acidity increase the sensation of sweetness and traces of alkalinity decrease it. For example, Demerara sugar, obtained directly from sugar-cane syrup which contains a certain amount of acids, seems sweeter than refined sugar; it contains, however, 4 % less saccharose. The aromatic substances in sugar have also a great influence. Consequently it is suggested that a small quantity of vegetable acids and aromatic substances should be added to sugar to increase its sweetness.

The value of sugar for making jam depends on several conditions, the principal of which are as follows :— 1) absence of micro-organisms capable of causing fermentation ; 2) reaction of the sugar, which should be neutral or slightly acid. Formerly refined sugars only were used in making jam, but it is now known that when refined sugars are treated with steam all bacteria in them are killed. As regards reaction, beet sugars were always distrusted, but these sugars are now obtained in a high degree of purity and are quite satisfactory for jam making.

Having analysed 2000 jams, G. W. SHAW concludes that those prepared with beet sugar are identical with those prepared with cane sugar. Further, he found 99.7 % of saccharose in beet sugar and 99.8 % in cane sugar. A. d. B.

1369 — **Bread-making with Manioc Flour** (1). — ALVES DE LIMA, A. M. (Presidente da Companhia Guatapar), in *Revista da Sociedade Rural Brasileira*, No. XXVI, pp. 429. Rio de Janeiro, August 1922.

In Brazil manioc flour cost in 1922 400 reis (about 11d. *at par*) per kg. ; wheat flour, almost all imported, cost double. Hence much research and experimental work was undertaken with the object of utilizing manioc flour for bread-making ; so far however the results obtained have not been satisfactory. For this reason the writer considered it worth while to call attention to the method used most successfully by the " Companhia Guatapar ", which manufactures manioc flour and makes bread with it.

Two kg. of manioc flour is kneaded with the requisite amount of water and allowed to remain in the kneading-trough for an hour. Any yeast, but preferably brewers yeast, is mixed with the dough. 2 kg. of wheat flour is kneaded separately, and this dough is mixed with the first and the whole is carefully worked up. The quantity of water to be used is the same as for 4 kg. of pure wheat flour ; as the manioc flour is the more absorbent, after previously measuring the water, only that which is left when the manioc flour has been kneaded is used for kneading the wheat flour. F. D.

1370 — **Production of Olive Oil in Greece** (2). — *L'Economiste d'Athènes*, Year I, No. 29, pp. 458-459. Athens, 2-15 Aug. 1922.

The production of oil in 1920 was most abundant, amounting to about 160 000 tons. This quantity may be divided into three classes :—

1) *Superfine oils*, including oils of from 1 to 2 degrees of acidity and representing a very small portion of the total production. They are produced in the Ionian islands, Mytilene and Arvali.

2) *Table oils*, including Greek olive oils of from 3 to 7 degrees of acidity, and representing about  $\frac{2}{5}$  of the total production. They come from the Peloponnesus (Kranidi, Astros, Calamata, Cythion, etc.), Mytilene, some Provinces of Crete and the Ionian islands.

(1) See R. Oct. 1922, No. 1107. (Ed)

(2) See R. Oct. 1922, No. 1099. (Ed)

3) *Industrial oils*. — These oils have from 8 to 25 degrees of acidity and represent about the remaining two fifths of the total production of Greece. They are produced in Crete (Kanea, Rethymnos), at Mytilene and in some Provinces of Old Greece. These oils can be used in industry and soap-works. The export of these 3 classes of oil began on May 15, 1921 after permission of the Ministry of Revictualling and has amounted to 7 million *okas* (1 *oka* = 1.25 kg.). The prices of oils during the year 1921 have undergone great fluctuations due on the one hand to forecasts of a short production for the current year, forecasts which have been realized (for the crop only amounted to about 40 000 tons) and, on the other hand, to the heavy fall in the Greek exchange. G. A. B.

1371 — **The Grape Syrups and Preserve Industry.** — BORGHI M., in *Giornale di Chimica industriale ed applicata*, Vol. IV, No. 9, pp. 396-402. Milan, September 1922.

With a view to the increased development of the vine growing industry, an attempt has been made for some time past, not only on the part of the trade, but also by economists and persons interested in hygiene, to use grapes for other purposes viz., the manufacture of sweet substances containing no alcohol: must, syrup, preserve, etc.

Whereas alcohol is not a true food and is to a certain extent injurious, the grape-sugar which is the chief constituent of must has a high nutritive value and from the health standpoint is superior to beet and cane sugars, for in the must, it is associated with ferments that facilitate its assimilation.

The composition of must is as follows: glucose (120 to 240 gm. per litre), tartaric acid, malic acid, tannins, other acid and neutral organic salts (5 to 15 gm. per litre), albuminoids, lecithin, gums (8 to 14 gm. per litre).

From concentrated musts, the lecithins and albuminoides are removed, being insoluble compounds. In concentrated syrups, the sugar content is double and three times as high, or even higher, but the nutritive substances are for the most part lost.

When concentration is brought about by the agency of heat, the ferments and aroma are destroyed. The prevention of this loss is the subject of much experimental work now in progress.

The home-manufacture of must and its products dates from remote antiquity. In Emilia especially, it is the custom to prepare the "sughit" (juice) by reducing the must to  $\frac{1}{3}$  and adding flour. In other districts, some of the acidity is neutralised by the introduction of marble-powder or chalk.

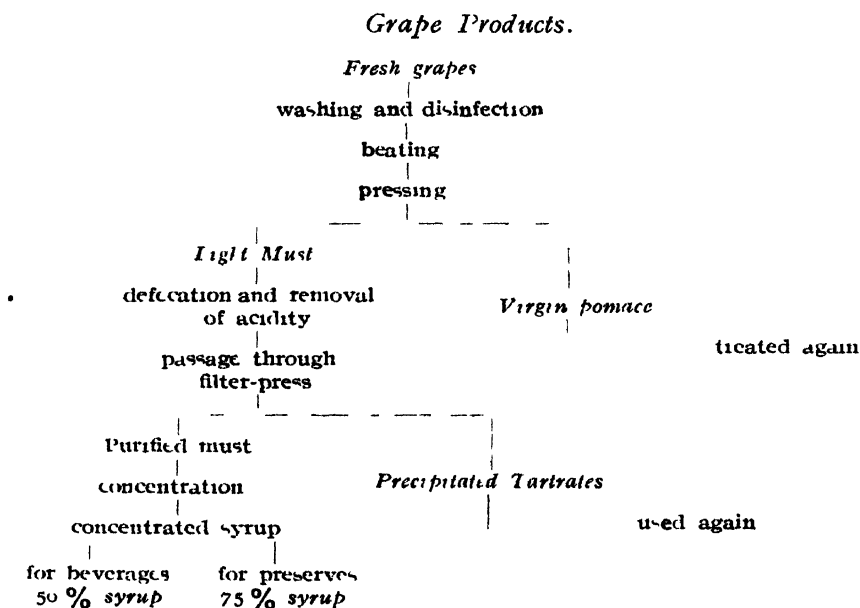
There are no industrial establishments of any size which are engaged solely with the production of concentrated musts.

The author gives the general scheme of such an establishment and describes the various stages of the industrial process. First the must is obtained. The grapes selected are weighed and put into mechanical beaters and presses. The must may be treated in 2 different ways. For the preparation of a simple or sterilised syrup at the lowest possible tem-



perature, it is cleared by filtration and bottled. In making concentrated products, the must should be freed from acidity by chemical reagents (calcium carbonate, etc.), then passed through a filter-press and concentrated in a vacuum at 50°-60° C. The concentrated syrup, which resembles grape-jelly, can be sold as it is, or used as a base for special syrups preserves, etc.

Calculating the must yield at 50 %, one quintal of grapes of an average of 18° (glucometric) yields 24 kg. of semi-concentrated syrup with 50 % glucose, or 16 kg. of concentrated syrup with 75 %.

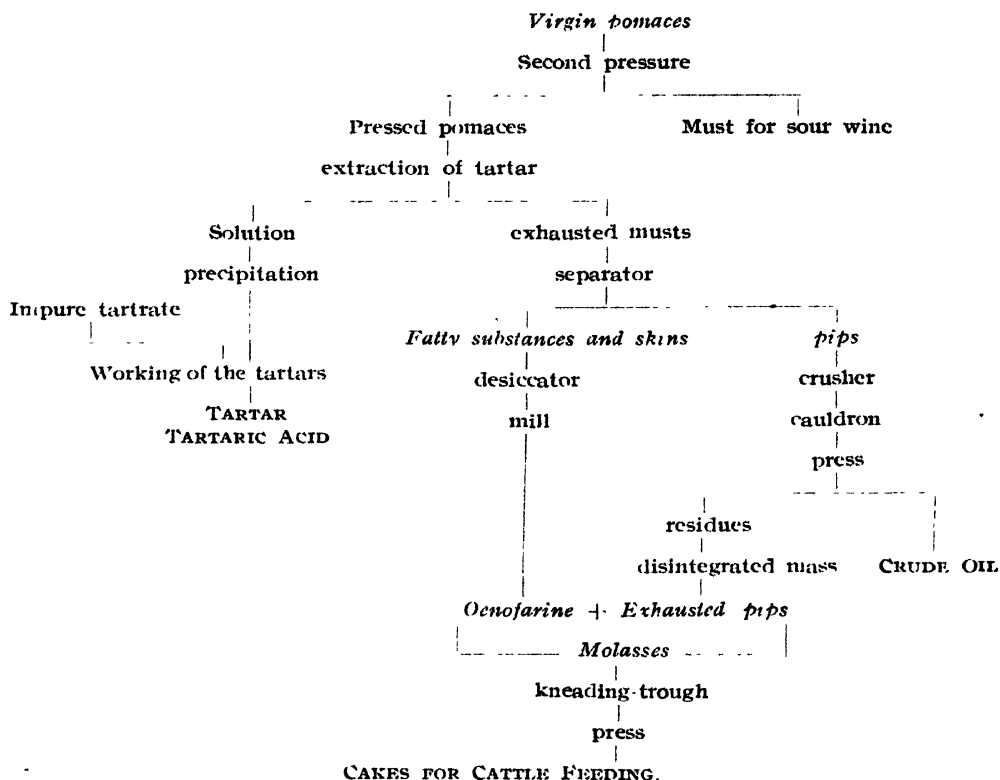


*Working up the grapes.* — The residue after pounding, is composed of unfermented pomace containing a certain amount of must. The pomace can be distilled with the addition of a little fresh must, to make sour wines, or for the extraction of alcohol. The pomaces resulting from the two processes are composed of 28 % pulp, 48 % skins, and 24 % pips. The first by-product is cream of tartar; this is extracted with boiling water, in which it crystallises. The cream of tartar present in pomaces ranges from 1.5 % to 5 %.

The pips are separated mechanically from the pomace; they contain 14 to 20 % oil, 9 to 12 % carbohydrates and 10 to 11 % nitrogenous matters. They can be worked over again to yield crude oil for lighting and soap-making; this oil, if refined can be used for human food, and cakes made from it are given to stock. A colouring matter, oenocyanin, is obtained from the grape-skins. The pips and skins of grapes are ground

to make cakes and can also be used as a fertiliser either alone or preferably mixed with dung. The stalks may be employed as fuel, and yield an ash containing 40 % of potash.

*Working up of by-products.*



The grape industry therefore furnishes a great variety of products and none of the material is wasted. The working up of the by-products is technically more complicated than the manufacture of the chief products. A well-organised establishment is absolutely necessary to deal with all the branches of the work. Owing to the present variable condition of the markets, it is impossible to develop on a large scale, but the new industry presents itself under the most auspicious conditions, for its sole object is both hygienic and social, viz. the substitution for alcohol of products having great nutritive value which could in addition prove a source of considerable wealth, having regard to the fact that exportation would be an easy matter.

A. de B.

1372 - **Dairy Production in Czecho-Slovakia** (1). — I. CHOCENSKY, Ch. (Chef de l'Institut lactologique), La production laitière en Tchécoslovaquie. — II. I. Industrie du lait en Tchécoslovaquie. — III. Le contrôle de l'utilité des animaux domestiques à l'étable. *Bulletin du Ministère de l'Agriculture de la République Tchécoslovaque*, Year III, No. 4, pp. 25-28. Prague, Oct. 1, 1922.

I. — According to statistics for 1911, there were 2 279 670 dairy cows in the Czecho-Slovakian Republic. According to estimated figures for the December 31, 1920 the number had fallen to 1 984 457.

Before the war there were 62 Czech co-operative dairies in the Republic in which 19 million litres of milk a year were used and 23 German co-operative dairies which used 26 million litres of milk a year. There were besides 392 dairies belonging to owners of large estates, to large milk producers and to Czech dairy farms dealing with milk production, on which 69 million litres of milk were produced and 22 similar German establishments with a production of 8 500 000 litres of milk. Allowing for the milk directly consumed and the milk used in the dairies, there remains an excess of about 376 million litres which were utilized in the farms, faulty methods being often followed. The national production fully suffices for home consumption which is estimated at 190 litres per head per annum in the country and 130 litres in the towns.

Before the war, the annual production of cheese was 24 351 qx. in Czech countries and 52 000 qx. in Slovakia. In the former the annual consumption exceeded the production by 14 000 qx., but in Slovakia there was a surplus production which compensated for the deficit. The production of butter was sufficient to cover the consumption, estimated at 5 kg. per head per annum.

In Slovakia the consumption of butter is 3.75 kg. per head per annum; in place of butter a thick small cheese called "brynza" is used.

The writer recommends:— development of dairy cow breeding, national manufacture dairy products with a view to exportation, and especially the establishment of co-operative dairies and markets for collecting milk.

II. — With the exception of the agricultural co-operative dairy of Troja and the co-operative dairies of Bohušovice, Louny, Tábor and Kolín, the largest and best managed dairies in Bohemia belong to private owners. As an example mention may be made of the Radlice-Smichov dairy, which, before the war, used 75 000 litres of milk and has branches (called "complementary") which in times of emergency sent properly chilled milk to Prague and at normal times converted it into dairy products. This dairy manufactures milk-sugar (exported to England and Holland) from whey and the condiment well known under the name of "ilsa".

The writer recommends the establishment of similar agricultural undertakings in Bohemia, at Prague and Plzeň; further, at least 180 co-operative dairies should be started producing at least 100 litres of milk

(1) See R. Dec. 1921, No. 1194. (Ed.)

daily and an establishment for making soft white cheese and small cheeses.

In Moravia there are many co-operative dairies (115 Czech, 29 German) which undertake successfully all branches of the dairy industry, but especially the production of superior quality cheeses.

Silesia has 17 co-operative dairies, a number which ought to be increased.

III. — In Bohemia, control of dairy production (and of the corresponding consumption of forage) was introduced in 1905 by 41 control associations; the number of controlled cows reached 10 262 in 1914. In Moravia, such control was introduced in 1909 and in Silesia in 1913.  
F. D.

1373 - **Condition of the Dairy Industry in Hungary.** — KRETSCHMER, K. (Budapest), in *Molkerei-Zeitung*, Year XXXVI, No 69, p 1557 Hildesheim, Sept 12, 1922.

In Hungary the breeding of dairy cows fell off during the war and during the first following years, especially as regards the quality of the animals bred, but it is now increasing and improving. In small centres and in the country, central stations have been established for collecting milk, which arrange for its immediate refrigeration and consignment to Budapest in refrigerated wagons. At Budapest the distribution of milk is carried out by two large central dairies. Each of them distributed 70 000 litres in 1921, as against 140 000 litres in 1914.

In spite of this organisation and although Hungary produces more milk than is required for home consumption, difficulties of various kinds (of transport, insufficient co-operation, etc) cause the requirements of large centres, and especially of Budapest, to be barely satisfied. A fairly large quantity of unsold milk remains therefore in the country places, which serves to supply the acidified milk industries. As these have a surplus production they supply mainly for export.

The "Terra, Milchprodukten-Industrie A G." Company was formed at Budapest for the manufacture of acidified milk and for the export of the produce. The numerous establishments belonging to it in the country collect the sour milk which is then sent to the central establishment in Budapest where it is prepared according to its quality. Most of the Hungarian coagulated sour milk is manufactured by this Company.

Another of its products, which is exported to many countries is butter-milk curdled and dried ("Trochenuarg") the quality of which is very nearly equal to casein of French manufacture. The manufacture of cheese from sour milk is still only done on a small scale: the "Olmützer Quargel" are mainly made in summer, especially for export, in winter they are also used for home consumption. Recently methods of rapid ripening have been adopted and the manufacture of soft and hard cheeses has been started and rapid progress has been made. Of the former, the Camembert type is mainly made. Sheep's milk is also much used.

In short, it may be said that the production of milk has decreased in Hungary compared with the pre-war period, but that the dairy industry has made progress.

F. D.

1374 - **Scientific and economical Study on Milk Refrigeration with Drum Refrigerators.** — ROSSI, F., in *Annali dell'Istituto sperimentale di Casaccio in Lodi*, Vol. 1, No. 4, pp. 141-150. Lodi, September 1922

A comparative study of the methods of milk refrigeration most in use : 1) with water ; 2) with water and ice ; 3) with water, ice and salt. The refrigerator used in this experiment had a drum and was capable of freezing 400-450 litres of milk per hour.

This type has 3 essential parts :

- 1) A rectangular section reservoir with an opening in the bottom closed by a special tap.
- 2) Double tubular surface placed vertically under the reservoir.
- 3) Cylinder or drum, inside which a tube or spiral runs lengthwise, and of which one of the ends communicates with the tube for drawing off the water, and the other, by means of a pipe end, with the inner refrigerating surface.

The milk passes from the reservoir through a perforated hopper whence it descends in a thin sheet on to the two sides of the tubular surface, then on to the outer surface of the drum and into the recipient placed below.

The writer's observations, which he has set out in 3 tables, show that in refrigerating, the milk passed from initial temperatures of 33-34° C to 15° C (on an average) with water — 7.8 to 10° with ice — 8.3 to 10.2° with water, ice and salt.

As regards the increased degree of preservation acquired, the initial acidity (7.2-7.8 Soxhlet %) had passed, 16 hours after refrigeration, from 0.2 to 0.4 %, whereas for the same milk not refrigerated, it had passed from 0.6 to 2.2 %.

This result is confirmed by the reductase test : the quicker the milk has been refrigerated, the longer the time necessary for the decoloration of the methyl blue.

Generally, the greatest falls in temperature took place when the pressure of the milk falling into the recipient decreased ; consequently to ensure uniform refrigeration, the flow from the reservoir should be maintained at a constant speed.

The best results in refrigeration are obtained by completely filling the drum with finely crushed ice ; the temperature of the milk was thus reduced to 7 % ; it therefore cooled better than with the water, rough ice and salt mixture.

On the assumption that a workman, who is paid fcs. 2.20 per hour, only looks after the changing and emptying of the apparatus, the cost of refrigeration with water only would be 0.55 lire per quintal of milk ; with water and ice, which costs 14 lire the quintal, 2 lire per quintal ; and with water, ice and common salt which costs 0.14 lire per kg. 3 lire per quintal of milk refrigerated at about 8° C.

F. D.

- 1375 — **Bitter Milk at a late Stage of Lactation.** — PALMER, L. S. (University of Minnesota, St. Paul), in *Journal of Dairy Science*, Vol. V, No. 2, pp. 201-211. Baltimore, March 1922.

Examination has been made of instances of milk with a bitter taste due to the following causes:— bacteria — ingestion of certain plants — diseases of the udder. To these causes it is possible to add another: it is found that healthy cows, kept on a uniform diet, give towards the end of the lactation period, milk which has a very sour smell within 24 hours of milking, and tastes very bitter. The abnormal smell and taste pass into the cream. The addition of formalin to the milk just drawn from the cow does not prevent the appearance of these disagreeable features. Moreover, the cream is difficult to churn.

The writer, when studying this phenomenon found that it was caused by the active secretion in the milk of a lipase which rapidly hydrolises the contained fat, even at a fairly low temperature, setting free fatty acids, particularly volatile acids especially butyric acid, which are the cause of the rancid smell and bitter taste. The anomaly is not due to bacteria and can be effectively retarded, if not entirely prevented, by heating the freshly drawn milk for a few minutes at 75°. F. D.

- 3376 — **Manufacture and Composition of Milk Powder and its possible Influence on the Preservability of whole Milk Powders** (1). — PALMER, L. S. and DAHLE, C. D. (University of Minnesota, St. Paul), in *Journal of Dairy Science*, Vol. V, No. 2, pp. 240-245, 3 figs. Baltimore, March 1922.

Whole milk powders, if manufactured by drying a liquid film passing over cylinders, heated internally keep much better than if they are manufactured by drying a fine spray of milk evaporating rapidly in a heated chamber. In the latter case the product has a greater tendency to become sour smelling.

The writers, believing that this difference in behaviour might have some connection with a difference in the microscopic structure of the granules, investigated the structure and found that granules of powders manufactured by the first process contained no air inside them, while granules of powders manufactured by the second process contained a small bubble of air in the middle, which was larger in the case of a spray caused by centrifugal force than in the case of a spray caused by pressure. They consider that the presence of air in the granules of milk powders of the latter type contributes largely to the fact that they are particularly liable to sebaceous deterioration, through oxidation. F. D.

- 1377 — **Bacterial Contents of Milk Powder.** — SUPPLER, G. C. and ASHBANG, V. J. (Research Laboratory, the Dry Milk Company, New York City), in *Journal of Dairy Science*, Vol. V, No. 2, pp. 216-228. Baltimore, March, 1922.

Bacteriologic research on milk powder may be said to have hitherto been limited to the study of pathogenic micro-organisms and particularly to that of tuberculosis. DELÉPINE and other writers have stated that in

(1) Cf. O. F. HUNZIKER, *Condensed Milk and Milk Powder*, 3rd Ed., 383 p., 111 fig. La Grange, Illinois, 1920. (Ed.)

normal conditions the number of bacteria per gramme of powder, as it leaves the drying cylinders, is very small (usually barely a few hundred), but that fresh contamination is easily caused by subsequent manipulation. The number of bacteria in freshly manufactured milk powder depends on the method of preparation. In commercial powders there is a fairly large percentage of sporiferous bacteria of the *B. mesentericus* and *B. subtilis* type, as well as orange-coloured and white cocci. Most of the sporiferous species survive the drying heat while the non-sporiferous forms result from contamination of the milk powder after it leaves the drying cylinders.

Although the bacterial contents of milk powder have probably no great influence on its hygienic value or preservability, the writers studied it with a view to obtain data to explain normal and abnormal conditions by this means. From the results obtained as a whole they draw the following conclusions:—

When the number of bacteria exceeds 1000 per gramme of powder prepared by JUST's method (drying by passing a liquid film between two cylinders heated internally and turning in opposite directions), it may be assumed, that in most cases these bacteria are derived from a fresh contamination after manufacture.

The number of bacteria in freshly made milk powder, which has not undergone fresh contamination, does not seem to depend on the number in the milk before drying, provided that the latter contains a normal flora.

Powder manufactured by JUST's method, normally contains a smaller number of bacteria than powder prepared by drying a spray of milk.

Bacteria in milk powder die rapidly during its preservation; in ordinary powders manufactured by JUST's method they become approximately constant after 2-4 months.

The presence of a large number of bacteria in milk powder produces no appreciable effect on its preservability, when the moisture is kept within the limits which make the sale of these powders possible. F. D.

#### 1378 — Technological and economic Data on some Types of Italian Cheeses. —

FASCETTI, G. (Direttore dell'Istituto sperimentale di Caseificio in Lodi), in *Annali dell'Istituto sperimentale di Caseificio in Lodi*, Vol. 1, part 4, pp. 134-139. Lodi, 1922.

The writer gives the following technical and economic averages, which are the result of the work in the "Istituto sperimentale di Caseificio in Lodi" on the principal cheeses obtained there, which are also those most made in Italy (1).

(1. On the Italian cheese-making industry (technical and statistical data), see: C. BESANA, I latticini maggiormente consumati in Italia, in *L'Industria lattiera e zootecnica*, Year XIX, No. 12, pp. 135-136. Reggio Emilia, Dec. 1921; Year XX, No. 1, pp. 3-4, January, 1922; No. 2, pp. 15-16, February 1922; No. 3, pp. 27-28, March 1922; No. 4, pp. 41-42, April 1922.

The soft cheeses ("stracchino", "gorgonzola", "robiolini", "formaggi Galbani", "Crescenza", etc.) are made mostly in Lombardy.

The hard cheeses are made on the one hand either with whole or more or less skimmed

TABLE I. — *Technical Data.**Gorgonzola.*

## Soxhlet acidity :

Per 100 of milk before working . . . . .	7.5 gm
Per 100 of serum after working . . . . .	4.9 gm

*Caciocavallo.*

## Soxhlet acidity :

Per 100 of milk before working . . . . .	7.5 gm
Per 100 of serum ferment used . . . . .	27.0 gm
Serum ferment added per 100 of milk . . . . .	1 litre
Temperature of warm serum . . . . .	65° C

## Soxhlet acidity after fermentation :

Rich caciocavallo, per 100 of serum . . . . .	13-14 gm
Poor caciocavallo, per 100 of serum . . . . .	16-17 gm

*Asiago.*

## Soxhlet acidity :

Per 100 of milk before working . . . . .	7.5 gm
Per 100 of serum ferment used . . . . .	30.0 gm
Serum ferment added per 100 of milk . . . . .	1 litre

## Temperature at which cooked :

Rich asiago . . . . .	40°-2 C
Poor asiago . . . . .	40°-0 C

cow's milk, or on the other, with whole ewe's milk (in Italy goat's milk is unimportant with regard to cheese-making). To this class of cheeses belong the "grana" with its subtypes "parmesan" (from Parma), "lodigiano" (from Lodi) and "reggiano" (from Reggio Emilia) — the Emmenthal, which has also been made in Lombardy on a large scale for about 40 years — the "Bitto", the "Montasio" and the "fontina" cheeses of a similar type which are made in the alpine zone which terminates in the Valley of Aosta — the "caciocavallo" and the "provolone". Among the ewe's milk cheeses, the "pecorino romano" is of considerable importance.

On the Alps during the summer cheeses are made in the "baite", the temporary habitations of the shepherds after they have led their flocks out to mountain pasture. In the Prealps zone there are many dairy and cheesemaking associations; they generally handle from 3 to 5 qx. of milk per day, rarely reaching 10 or more qx.

In Lower Lombardy forage production, livestock rearing, the production of milk and milk products (butter, cheeses and condensed milk) are very important. The cheesemaking establishments are generally equipped in a modern way; some of them are quite industrial establishments, handling more than 100 qx. of milk daily.

Next in order of importance comes the zone of Emilia (the Provinces of Reggio Emilia and Parma), where cheesemaking takes place generally only for 6 months, beginning in April, i. e. during the period of the highest milk production.

In the Roman "campagna" the "pecorino" cheese is made at home and with ap-



## Soxhlet acidity after heating:

Rich asiago, per 100 of serum . . . . .	5.1 gm
Poor asiago, per 100 of serum . . . . .	5.6 gm

*Shrine from two milkings:*

## Soxhlet acidity:

Per 100 of milk before working . . . . .	8 gm
Per 100 of serum ferment used . . . . .	32 gm
Serum ferment added, per 100 of milk . . . . .	1 litre
Working temperature . . . . .	55° C
Soxhlet acidity per 100 of serum after heating . . . . .	5.6 gm

*"Grana", rich "reggiano" type (summer):*

## Soxhlet acidity:

Per 100 of milk before working . . . . .	7.6 gm
Per 100 of serum ferment used . . . . .	31.5 gm
Serum ferment added per 100 of milk . . . . .	2.7 litres
Cooking temperature . . . . .	53° C
Soxhlet acidity per 100 of serum after heating . . . . .	6 gm

*"Grana," poor "reggiano" type (summer).*

## Soxhlet acidity:

Per 100 of milk before working . . . . .	8 gm
Per 100 of serum ferment used . . . . .	24.5 gm
Serum ferment added per 100 of milk . . . . .	3.3 litres
Cooking temperature . . . . .	50° C
Soxhlet acidity per 100 of serum after cooking . . . . .	6.1 gm

paratus of the utmost simplicity, during the winter, before the ewes are led out to the Abruzzi mountains. In the Abruzzi, the Molise and Apulia, good "cacicavalli" are made from cow's milk. In the Provinces of Salerno and Caserta the "provature" and mozzarelle" cheeses, which are eaten when new, are made from buffalo's milk.

The making of small cheeses for family or local consumption from ewe's, cow's or goat's milk is extensively carried on throughout Sardinia. Among these should be mentioned the "fresa", which recalls the Lombard "stracchino". In the northern part of the island, the making of the "pecorino", of the same type as the Roman, had largely developed and given rise to a considerable export trade.

In Sicily typical cheeses are made from cow's, ewe's and goat's milk, either separately or mixed in various proportions. The "incanestrato" is made from mixed milk and the "formaggio siciliano" from cow's milk; it is used for the table when new, or grated when ripe.

Milk production in Italy, in 1914, was estimated by the writer at 31 200 000 hl. of cow's milk — 5 460 000 hl. of ewe's milk — 1 500 000 hl. of goat's milk — and 45 200 hl. of buffalo's milk; 5/6 of the cow's milk and almost all the ewe's milk are made into cheeses. Milk products in 1914 were estimated by the writer at: 500 000 qx. of butter — 1 600 000 qx. of cow's milk cheeses — 810 000 qx. of "caci pecorini" — 150 000 qx. of goat's milk cheeses — 9 000 qx. of buffalo's milk cheeses. Milk and milk products form one of the most important articles of the Italian export trade. (Ed.)

TABLE II. — *Economic Data.*

Types of Cheese	Quantity of Milk handled	Number of cheeses obtained	Total Weight after 24 hours	Average Weight of a Cheese after 24 hours	Buttermilk obtained	Average yield of New Cheese	Average yield of Butter
	litres		kg.	kg.	kg.	% in milk	% in milk
<i>"a pâte crue":</i>							
"Crescenza" from whole milk .	1 340	102	218.5	2.1	1.6	15.8	0.12
"Quartiolo" from whole milk .	2 715	171	412	2.4	13.5	14	0.5
Green "Gorgonzola" from whole milk . . . . .	4 175	58	515	8.8	7	12.6	0.5
<i>"a pâte filée":</i>							
"Caciocavallo" from partially skimmed milk. . . . .	8 445	302	706	2.3	164.4	8.3	1.9
<i>half-cooked:</i>							
Medium "Asiago" (from one milking) . . . . .	26 265	156	1 900.2	12	765	7.1	2.8
Rich "Asiago" (from two milkings) . . . . .	36 040	391	3 085	7.8	698.8	8.5	1.9
<i>cooked:</i>							
"Sbrinz" . . . . .	16 015	49	1 146.7	25.4	356.2	7.1	2.2
"Grana", "Reggiano" type from two milkings, of which one only skimmed . . . . .	27 730	75	1 851	24.5	549.8	7.1	2.1
"Grana", "Reggiano" type from two milkings, both skimmed .	12 600	37	784.5	21.2	374.7	6.2	2.9

F. D.

1379 — **The Food Value of Bull Beef.** — SPARAFANI, G. C., in *Allevamenti*, Year III, No. 9, pp. 346-347. Palermo, September 25, 1922.

The writer who is Manager of the Public Slaughter-house at Cittanova (Province of Reggio Calabria) has subjected similar muscles from bullocks and young bulls to comparative analysis with the object of determining the content in glycogen by PIETTRE's method; the animals were of the same breed (Podolian) and in the same state of nutrition; the results, all relating to 20 gm. of muscle, were as follows:—

*Psoas muscle*:— 15 months old bull, 256 milligrammes of glycogen — 18 months old bullock, 237 mgm.

*Gluteal muscles*:— 25 months old bull, 372 mgm. — 36 months old bullock, 345 mgm.

*Lumbar muscles*:— 9 months old bull, 156 mgm. — 11 months old bullock, 143 mgm.

[1378-1379]

*Intercostal muscles* :— 20 months old bull, 267 mgm. — 20 months old bullock, 238 mgm.

*Skeletal muscles* :— 30 months old bull, 288 mgm. — 24 months old bullock 259 mgm.

*Pterygoid muscles* :— 14 months old bull, 269 mgm. — 10 months old bullock 237 mgm.

Bull beef therefore contains a larger proportion of glycogen than bullock beef; it is consequently more suitable as food for working people, who in several countries, prefer it, both as regards the dynamogenic action of the glycogen, and in consideration of the anti-toxic action of the glycogen directed especially against the poisons generated by the digestion of muscular albumens.

F. D.

1380 — **Resolutions passed by the Congress of the National Federation of the Live Stock Trade.** — BENOIT, S, in *Revue de Zootechnie*, No. 5, pp. 443-446. Paris, Feb. 15, 1922.

The Congress of the National Federation of the Live Stock Trade was held at Paris on November 5, 1921, when the following resolutions were passed.

1) That, for live stock brought into open markets, the tax on sale values shall be replaced by a slaughter fee, the rate of which shall be that of the present tax and the method of collection fixed by a regulation of the public authority.

The Federation considers that the proposed reform would have the effect of increasing the Treasury receipts, simplify their collection and restore fiscal equity, both for the benefit of trade, and of the consumers.

2) That the Minister of Finance should be requested to have the coefficients 3 to 9 %, adopted in 1917 for fixing the tax on industrial and commercial profits, revised in favour of live stock dealers.

3) That the law of February 23, 1905, which limits the right of appeal in case of seizure for bovine tuberculosis to the last seller, should be repealed.

4) That, considering the numerous actions pending regarding animals found to be affected with foot-and-mouth disease after sale, owing to the indefinite character of the sanitary law on the question, a detailed inquiry should be made as to the various modifications urgently required in the Sanitary Code.

5) That the application of the French sanitary laws should be extended to Alsace-Lorraine.

6) That provisions, goods and all kinds of articles to be conveyed by goods train shall be despatched on the day after consignment. That live stock shall be despatched on the day of consignment and by the first train leaving, provided loading has been done at least 3 hours before the departure of the train.

7) That the time taken in transit by goods train should enable live stock to be carried 225 km. in 24 hours.

AGRICULTURAL  
PRODUCTS;  
PRESERVING,  
PACKING,  
TRANSPORT,  
TRADE

[1879-1880]

8) That live stock shall be delivered to consignees 3 hours after actual arrival at the Station.

9) That no maximum value shall be fixed for animals carried at the Passenger train and Goods train tariffs, 1 and 101; but, in case of dispute, that such value shall be fixed by the decision of an expert.

10) That for consignments either by Passenger or by Goods train applications for trucks shall be made at the despatching station 24 hours in advance, and the trucks supplied at the end of that period, it being understood that in no case shall this 24 hour period be included in calculating demurrage.

11) That the managements shall only be bound to supply such trucks as are available, without any obligation as to size.

Whenever Companies supply consignors with a truck larger than applied for, the rate shall be calculated on the size of truck corresponding to the number of animals loaded.

12) That cattle of all breeds, not exceeding an average weight of 400 kg. per truck, shall be considered as equivalent to Brittany cows.

13) That the Companies shall be requested to diminish as far as possible the rates of schedules 1 and 2 of the goods train tariff 1 and 101, and that a special tariff shall be fixed for unfattened stock intended either for fattening, for draught purposes or for breeding.

14) Having regard to the fact that the period of 24 hours allowed for the transmission of goods from the points of transit to the Paris-Bestiaux Station is obviously too long, the Federation requests that this period may be reduced to 12 hours.

15) The Congress requests the Companies when constructing and refitting trucks for renewal purposes, to provide a small latticed ventilator 25 cm. long, at each corner of the truck, at 30 cm. above the floor, with a shutter allowing for closing in winter.

16) As animals are preeminently perishable goods, the Congress requests that in all cases the carrying-agents should let cattle trucks have precedence of all other goods which are not perishable.

17) Considering that as a rule every time that consignments of animals have to pass over several sections of railway, considerable delay is experienced, the Congress resolves earnestly to request the Railway Companies to take immediately action to accelerate transport in such cases.

F. S.

## PLANT DISEASES

### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1381 — Injuries produced on Weymouth Pines and other Plants due to Causes of chemical origin. — SNELL, W. H. and HOWARD, N. O., in *Phytopathology*, Vol. XII, No. 8, pp. 362-368, figs. 2, 1 pl. Lancaster, Pa., Aug. 1922.

At the beginning of August 1921, in east Massachusetts, some Weymouth pines were noticed, over an area about 800 m. long by 400 m. wide, with reddened leaves. From a distance of a few metres the needles appeared to be quite dead, the red colour of the leaves being so uniformly distributed. But on examining the branches closely it was found that the leaves were not quite dead and that the trees were still living. The youngest needles seemed to have suffered most, although all had to a certain extent changed colour. Subsequent examination of the zone shewed that not only the pines but also other trees (*Quercus velutina*, *Q. alba*, *Q. bicolor*, *Betula populifolia*, *Prunus serotina*, *Rhus toxicodendron*, *Lysimachia quadrifolia*, *Pteris aquilina*) were injured. In most cases the injury consisted in a browning or whitening of the edges of the leaves.

*Carya* sp., *Ulmus americana*, and *Picea pungens* however did not appear to be attacked.

*Picea excelsa* trees which were growing just on the edge of the attacked zone had many reddened leaves, while those which were growing a little further west, and apparently outside the zone, were perfectly normal.

Persons living or working in the neighbourhood, stated that this type of discolouration had appeared just in the same place during the early part of the two previous summers. In each case it was noticed that most of the trees had perfectly normal leaves again and only a few were killed.

Another lot of pines growing about 800 m. to the north-east were so seriously attacked in the previous years that they had to be felled.

Careful inquiries regarding the causes of the mischief seemed to indicate that it was most probably due to a brick-kiln situated nearly 300 m. to the north of the attacked zone and at about 120 m. from the nearest pine. As a rule during the last 3 or 4 days of each baking period it was usual to put bituminous coal on the wood which was the ordinary fuel of the kiln; the acrid smoke, from the burning of this coal with a relatively high sulphur content when driven by the wind, which, as was ascertained, had blown in the direction of the attacked trees, must have caused the injuries described.

A second case of damage due to chemical causes was noticed during the summer of 1921, along a road in New Hampshire. It was characterised by a reddening of the leaves and the death of Weymouth pines. Trees of all sizes were attacked; those whose diameters were not more than about fifteen centimetres were killed and on full-grown pines large portions of the crowns died completely or portions of the leaves died. The reddening of the leaves was difficult to distinguish from that caused by the smoke in the previous case.

It was found that in this second case the trouble was due to a very simple cause. The road had frequently been dressed with chloride of lime to bind the gravel and prevent dust. This was the only treatment which the road had had for several years. Before dressing the tins containing the lime chloride were arranged at regular intervals along the road and in most cases under the pines.

These tins were not in good condition and a certain amount of chloride of lime either in a dry state or dissolved in water absorbed from the air was spilled on the ground, and percolated into it. As every tree under which a tin had been left was attacked, it was clear that the chloride of lime was the cause of the injury. Trees whose trunks were near the tins were killed, those which were further away but where the tins had still been placed on the ground occupied by the roots, were partly injured.

Birch trees and elms under which tins containing chloride of lime had been placed were more or less seriously injured. On these trees the damage consisted in the withering of the edge of the leaves and the browning of the leaves themselves. In the case of the elms a pronounced crinkling in the leaves towards the top and partial defoliation on the upper branches were noticed but these trees did not die.

Pines and broad-leaved trees under which no tins of chloride of lime had been placed were quite healthy.

G. T.

1382 - "Chlorosis" in Pineapples. — See No. 1314 of this Review.

1383 - "Chlorosis" in the Vine and deep Ploughing. — See No. 1318 of this Review.

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

#### GENERAL

1384 - Biochemistry of *Sclerotinia cinerea*. — See No. 1284 of this Review.

1385 - Experiments on Vegetable and Animal Plant Pests carried out at the Experimental Station at Rothamsted, England. — See No. 1250 of this Review.

#### PARASITIC DISEASES OF VARIOUS CROPS

1386 - A New Potato Disease observed in Morocco. — MIEGE, in *Bulletin de la Société de Pathologie végétale de France*, Vol. IX, Part 2, pp. 109-112. Paris 1922.

In 1920 and 1921, a new potato disease was reported from Morocco which causes considerable damage to the crops, but varies in its intensity and attacks most of the cultivated varieties of potato at all seasons of the year.

From field observations made at Rabat, the disease on the aerial portions of the plant is clearly basipetal, for it always starts at the extremity of the branch and usually, although not invariably, begins at the apex, or in the centre of the plant. The terminal leaflet becomes covered with brown patches as if it were scorched, and then turns black and withers quickly and completely. The petiole is immediately infected at its upper end and this part soon dries up and breaks off leaving intact the lower portion which remains healthy and green.

The disease continues to spread and quickly passes down the branch to the stem, destroying successively all the leaflets. At the end of some days the whole branch turns entirely black, withers and falls off; the main stem itself is attacked and becomes covered with elongated, blackish patches that start from the point of contact with the infected branch.

Sometimes the tubers are attacked before they are ripe; in certain cases on the contrary, the disease only makes its appearance on the potatoes themselves some days, or even weeks, after they are lifted. On the surface of the tuber small violet-black spots are seen; at first they are few in number, but they gradually increase. Subsequently, the portion of the layer beneath these spots turns a livid blackish-brown, and the affected area extends progressively. The diseased spots liquefy and exude, under the pressure of the fingers, a rather clear liquid. Then the tuber soon rots and becomes unusable.

The potato crop is much reduced, for even before the disease appears on the tubers, their number and size are much diminished.

This disease is probably of bacterial origin.

A bacterium has been isolated from infected plants and cultivated. This microorganism was inoculated into twenty sound plants with foliage belonging to the "Géante sans pareille" variety. The first symptoms of the disease showed themselves twelve days after the inoculation. Later it spread and became more virulent, and at the harvest time, several of the tubers exhibited the characteristic round violet-black spots. Further researches are however necessary, for it is impossible to arrive at any definitive conclusions respecting the disease from the preliminary experiments hitherto made.

G. T.

1387 - New *Micromycetes* living on *Cinchona* spp., in Indo-China. — VINCENS, F., in *Bulletin de la Société de Pathologie végétale de France*, Vol. IX, Part. 2, pp. 125-133, figs. 4. Paris, 1922.

Some years ago, nurseries of *Cinchona succirubra*, *C. Ledgeriana* and of a variety raised from seed obtained in Java from a cross between these two species, were started on Mount Honba.

In September 1920 the best grown plants of *C. Ledgeriana* had attained the height of 35 to 40 cm., but near them were other individuals only 15 to 20 cm. high, which bore only a few leaves and seemed about to die. None of the plants were perfectly healthy, for the least attacked had some leaves covered with spots and the laminae were frequently disfigured by perforations.

The disease had only lately assumed serious proportions (the recent fogs appeared to have favoured it) for the old leaves were relatively little injured. They bore some circular brown patches a few millimetres in diameter, of a dead-leaf brown and with a violet border perforated with holes of the same size and shape as the patches, thus proving that they were formed by the detachment of the dead tissue of the latter. On the younger leaves the patches were much more numerous; they often coalesced forming a chess board design covering the greater part of the surface.

The blades of the leaves nearer the tip of the plant were deformed, crinkled, and looked as if they had been torn. The green shoots bearing these leaves were malshaped, bent, sometimes slightly hypertrophied and also distinguished by the presence of abnormal suberous growths not infrequently of a cankerous appearance.

The lank, sickly plants which were clearly perishing, only had a few deformed leaves near their apex, while the ground around was strewn with withered, shrivelled, brown, spotted and torn leaves, most of them just like the young leaves still attached to the stems of less severely attacked individuals.

The disease appeared with the same characters on the leaves of the hybrid variety, though its shoots appeared to be healthy.

On the plants of *C. succiruba* which were visibly much more vigorous than those of *C. Ledgeriana*, badly infested leaves were relatively rare and all the shoots were healthy.

Three new species of *Phyllosticta* were found on the foliage of the diseased individuals. 1) *Phyll. honbaensis* n. sp., occurring chiefly on *C. succirubra* and seldom present on *C. Ledgeriana*; 2) *Phyll. cinchonae-cola* n. sp., occupying the same position on the dead parts of the patches as the preceding species; 3) *Phyll. yersini* n. sp., on the lower surface of the very young leaves that were still pressed against the bud, and on the discoloured shoot bearing them at the apex of the dying plant. On nearly all the specimens examined was found another Deuteromycete, *Phlyctaena Cinchonae* n. sp. Its fructifications were formed in the suberised bark, which wherever they occurred became very rugged, and mammelated, having the appearance of being covered with a number of large lenticels.

On the bark of the same trees there occur but, less frequently, *Phoma Cinchonae* n. sp. and *Guignardia yersini* n. sp.

The leaf-traces of a diseased stem left in a damp place for some days after it had been removed, were found to be invaded by *Dendrophoma Cinchonae* n. sp., while the rugged bark at the base of the same stem harboured *Physalospora Cinchonae* n. sp.

Only by artificial infection could the part played by each of these fungi in the evolution of the malady be ascertained, but although it was not possible to have recourse to inoculation, the author is certain of the injurious effect exerted by the three *Phyllostictae* and considers that the frequent



occurrence of *Phlyctaena* in the abnormally suberised bark of the young plants justifies this fungus being regarded as a parasite.

The copper mixtures tried for the control of the disease proved very injurious to the *Cinchona* seedlings.

In a place near the above-mentioned nurseries none of the *C. Ledgeriana* seedlings from the recent and numerous sowings showed any signs of the disease up to December 1921, when the author left Indo-China.

G. T.

1388 - *Pholiota praecox*, an Agaric injurious to Cultivated Lavender in France. — CHEVALIER A, in *Revue de Botanique appliquée et d'Agriculture coloniale*, Year II, Bulletin No. 13, pp. 482-483. Paris, September 20, 1922.

In a field of lavender (*Lavandula vera* D. C.) at Aups, Sainte-Baume, a certain number of the plants were found at the end of June 1922 to be withered and attacked by a kind of rot. The examination of the cracked surface of the large roots showed the presence of masses of white mycelial filaments that invaded all the under-ground portions of the plant. On a small swelling situated near the collar above one of the tap-roots grew the fructifications of a small Agaric which according to N. PATOUILLARD, seems to be a form of *Pholiota praecox* (Pers.) Quéf.

This is the first time that this fungus has been reported as causing rot in a cultivated plant.

The author recommends the uprooting and burning of all infected lavender bushes as the best means of arresting the spread of the disease. It is also advisable to drain the low-lying portions of the field to prevent the water standing when it rains. The removal of all weeds and the frequent working of the soil are measures calculated to promote the growth of the crop and the elimination of the parasite.

G. T.

1389 - *Mollisia Earliana*, an Ascomycete injurious to Strawberry Plants, in Ontario, Canada. — STONE, R. E., in *Phytopathology*, Vol. XII, No. 8, pp. 375-380, 3 figs. Lancaster, Pa., Aug. 1922.

In several places in Ontario, many strawberry gardens are seriously affected by a disease, the presence of which may be detected in May by the appearance of small irregular purple spots on the borders of the leaflets; stripes of the same colour appear simultaneously on the petioles and on the floral peduncles. Gradually the spots increase in size and meet each other so that the whole leaf may be attacked. As the spots develop they become grey or ash coloured with a purple edge, which finally disappears. As the disease progresses, all the leaves of the plant look dried up as if they had been scorched by fire. In the following spring the disease shows itself very early and may become serious before the strawberries are picked.

After picking, the disease makes rapid progress and all the leaves may dry up and become tindery as early as July or August. The diseased plants do not winter well and the crop in the following year may be very small.

All varieties are not equally attacked. It appears from observations

made in open fields that the common varieties of strawberry plants may be classed in three groups:— a) very sensitive:— "Clyde", "Glen Mary", "Doctor Burrill", "Pokomoke", b) fairly sensitive:— "Senator Dunlop", "Ruby", "William Belt"; c) slightly sensitive:— "New Williams", "Portia", "Parson's Beauty", "Enhance", "Vanoise", "Joe".

Examination of the tindery portions of the spots on diseased leaves and petioles reveals the presence of fructifications of a fungus corresponding to *Marsonia Potentillae* (Desm.) Fischer, which may be quickly grown on ordinary media.

A pure culture of this fungus inoculated on the leaves of the strawberry plant soon produced the typical characters of the disease observed in nature.

If strawberry plants are covered, many leaves survive the winter and remain green, the fungus winters on these in a vegetative condition and produces abundant conidia in spring. An ascophorous stage is abundantly developed from April to June on the dried leaves, particularly on those most exposed. This stage could be identified as *Mollisia Earliana* (E. and E.) Sacc. and is developed on the dried leaves of the strawberry plants after *Mars. Potentillae* and often the conidia of the latter are found on the leaf together with fructifications of *M. Earliana*.

The results of numerous cultural experiments and of inoculation have clearly shown that *Mars. Potentillae* and *M. Earliana* are metagenetically interconnected: in all cases in which the ascospores of *M. Earliana* have germinated, a pure culture has been obtained which has produced spores of the *Marsonia* type; strawberry plants inoculated with spores in suspension taken from a pure culture obtained from an ascospore have shown the typical spots of *Marsonia* and, later, typical fructifications of *Mars. Potentillae*. The control plants remained entirely free from the disease. A complete description is given of the ascophorous or perfect stage (*M. Earliana*) as well as of the Conidian stage (*Mars. Potentillae*).

Although no experiments have been carried out, it may be supposed that the disease may be controlled by the same means as those used in controlling the "leaf spot" disease of strawberry plants (*Mycosphaerella Fragariae* [Schw.] Lindau.) G. T.

1390 - Diseases and Pests of Pineapples. — See No. 1314 of this Review.

1391 - The White-Rot of the Vine (*Coniothyrium Diplodiella*) in Switzerland. — FAES, H. and STAEHELIN, M., in *Annuaire agricole de la Suisse*, Year XXIII, pp. 189-202, figs. 7, Berne 1922.

A contribution to the study of *Coniothyrium Diplodiella* (Speg.) Sacc., the cause of the white-rot of the vine.

The experimental researches made by the authors during the summer of 1921 in the vineyard of Pully, have proved that the stylospores produced the previous year in the pycnidia retain their virulence and are capable of infecting the crop next year. It is thus advisable to remove all the mummified bunches attacked by *Coniothyrium*, and carefully burn them immediately after the vintage. The stylospores of *Con. Di-*

*plodiella* can only infect the berries of the Chasselas variety if there are any lesions present. As hail is the sole agent producing lesions in large numbers on the grapes, white-rot is a disease closely connected with hailstorms. Isolated cases may however occur in Swiss vineyards, as a result of wounds inflicted by pruning instruments, "Cochylis", or the agency of birds.

The stylospores of *Con. Diplodiella* will not grow except in a medium containing sugar; they develop little, if at all, in rain or river-water. This is the reason why grapes with open wounds are rapidly attacked. In the laboratory, infection of Chasselas leaves was secured by placing on their surface grape-juice containing germinating *Coniothyrium* spores.

In order to infect the lesions on the grapes, it is necessary for some of the stylospores of the fungus to be present on the injured tissue. During 1921, the stylospores of *Con. Diplodiella* were rare, for the artificially-wounded but not infected berries did not contract the disease, though the disease developed regularly on the berries that had been punctured and infected.

The injury wrought by white-rot is intensified by every successive hailstorm which greatly increases the number of pycnidia and stylospores produced by the fungus. G. T.

## WEEDS AND PARASITIC FLOWERING PLANTS

1392 - The Crucifer *Nasturtium austriacum*, a new Weed in the United States. -- HANSEN, A. A. in *Torreya*, Vol. XXII, No. 5, pp. 73-77, 1 fig. Lancaster, Pa., September-October 1922.

In June 1921, the writer's attention was called to a weed which infests certain zones of the Borderland Farm at New Milford, Orange County (New York State). This plant grows in dense patches and interferes with the growth of all other plants.

At the time the plant was in full flower, and gave a yellowish appearance to the whole of the area attacked. In a meadow intended for pasture, more than 4 acres were infected by the weed. Patches were found two or three hundred yards from the zone most severely infested while the sides of the roads and farm tracks were completely overrun.

The plant, which appears to be a new variety, in the United States, has been identified as the European Crucifer *Roripa austriaca* Spach (= *Nasturtium austriacum* Crantz).

According to the owner of the farm, this Crucifer was introduced, on to his land about 1910 through impure grass-seed. At first the plants only formed a small patch which for several years did not extend very far. Care was taken to cut down the plant every year before the seeds formed, but it spread gradually, evidently by means of its horizontal roots. Of late years it has spread to such an extent as to cause uneasiness and at present occupies a total area of nearly 7 acres, but covering a zone much larger than the farm, which is situated on the borders of the New York and

New Jersey States, so that the region attacked though small, is actually in two States.

Having regard to the comparatively small size of the zone infested, it is important that control should be organised without delay, and all the more because if entered on at once it would not be expensive. A good method, judging from the experience gained in similar cases, is to station a man in permanent residence on the infested zone while the plant is growing for two years or more. His only work would be to prevent the formation of the parts of the Crucifer above ground, in order to exhaust the root system. Another method, which should also give good results, is based on continual spraying until the weed is completely exterminated. Crucifers are particularly affected by the action of iron or copper sulphate sprays. G. T.

1393 - *The Labiata, Salvia Aethiops, a Weed new to Oregon.* — NELSON, J. C., in *Torreya*, Vol XXII, No 5, pp 86-88 Lancaster, Pa., September-October 1922

In the summer of 1920, specimens of a weed growing in profusion in a lucerne field belonging to the farm of Leriocock about 1 1/2 km. to the north of Lakeview (Lake County), were sent to the herbarium of the Oregon Agricultural College at Corvallis.

This weed — which was identified as *Salvia Aethiops* L., a Labiata unknown formerly in Oregon — not only grew plentifully on the hard calcareous soil of the lucerne field where it smothered a certain number of the plants, but had also spread to the neighbouring, probably unirrigated, slope and was luxuriant on the light basalt soil covering it. *S. aethiops* has shown itself to be a hardy and very drought resistant plant. It continued to grow in the same place until 1922, and has proved to be a very prolific weed that propagates itself rapidly.

After some time had elapsed, the plant was found at Gossil (Wheeler County) viz., some 200 mls north of the place of its first appearance in Lake County. In the latter county, it grew mixed with the Cossack variety of lucerne, and was therefore supposed to have been introduced with the lucerne seed which had originally been imported from North Russia, although in the opinion of the author, the name Cossack would seem to denote a more southern origin, so that the Labiata may well have come from the shores of the Black Sea.

During the summer of 1921, another weed belonging to the *Salvia* family, and which has been identified as *S. sylvestris* L. was also found in Oregon, but this time in the County of Umatilla. G. T.

1394 - *Arsenic in the Control of Weeds.* — See No. 1281 of this *Review*.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS

### GENERAL

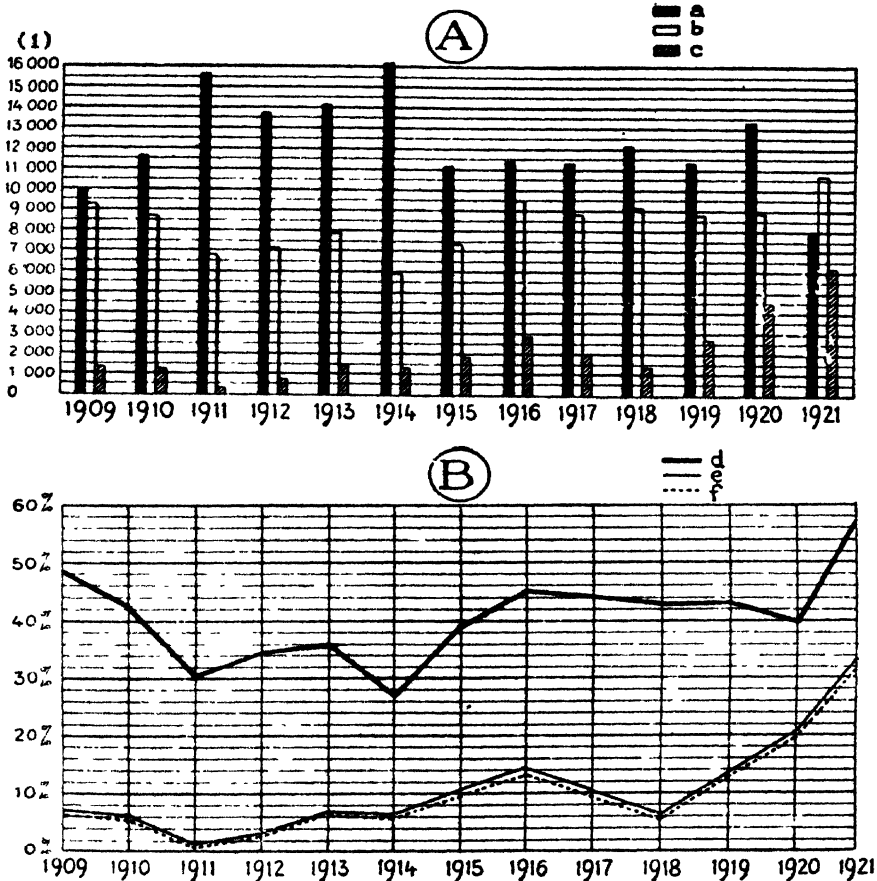
1395 - *Boll Weevil and other Causes of Damage to Cotton Crops in the United States.* — *Weather, Crops and Markets*, Vol II, No 9, pp. 169-189. Washington, D C., Aug 26, 1922.

The U. S. Department of Agriculture has made estimates of the boll weevil damage for each year from 1909 to 1921, inclusive. In 1909 the

[1392-1395]

damage amounted to 1,368,000 bales. In 1910 the damage was slightly less than in 1909, and in 1911 the damage was the least for any of these years, amounting to 338,000 bales. From 1912 to 1919, inclusive, the boll weevil damage fluctuated between 714,000 bales and 2,994,000 bales, this latter figure having been reached for the 1916 crop.

FIG. 1. — *Damages to cotton crop in the United States.*



EXPLANATION.

A. = *Cotton Production Prevented.*

- a = Quantity of lint picked ;
- b = Picked lint production prevented by all causes ;
- c = Picked lint production prevented by boll weevil.

(1) = bales.

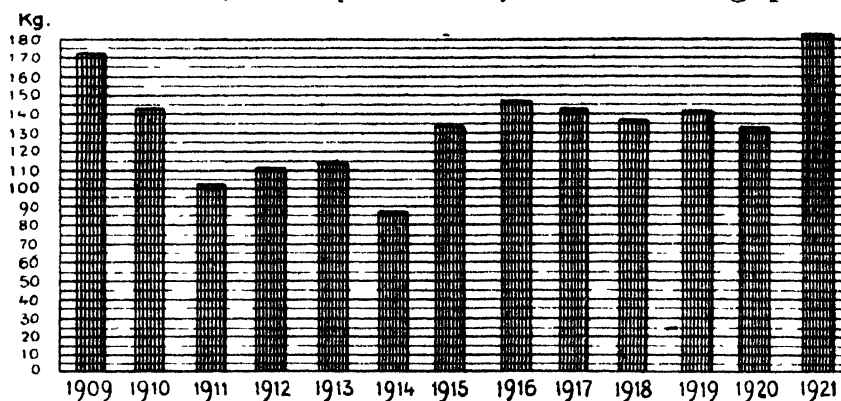
B. = *Percentages of Loss of Cotton.*

- a = Percentage of potential production prevented by all causes ;
- b = Percentage of potential production prevented by boll weevil ;
- c = Percentage of loss of cotton of a normal or full yield per acre due to boll weevil.

The economic burden of the boll weevil to cotton producers can be made more understandable perhaps by comparative figures. For example, the picked crop of cotton lint was 7,954,000 bales in 1921 and the weevil prevented the production of 6,267,000 bales. Hence the damage to the crop was equal to 79 % of the harvested crop. Had the weevil been innocuous the cotton acreage of 1921, small as it was, would have produced 14,231,000 bales of lint cotton.

To express the matter in another way, had it not been for the boll weevil the actual crop of cotton in 1921 could have been obtained from 66 % of the acreage cultivated. In other words, out of every 100 acres cultivated the producer received as his share the cotton from 42 acres, since causes of

(FIG. 2. — *Loss of cotton production by all causes. in kg. per ha.*)



damage other than the boll weevil prevented the production of 24 acres, and the boll weevil itself fed on the cotton raised on the remaining 34 acres.

The cotton production that the weevil has prevented has greatly increased in the last two years. Expressed as a fraction of the full potential production of cotton, the damage by the boll weevil in 1921 was about 34 % or, in other words, one-third of the potential production was prevented by this voracious pest. One-fifth or 20.5 % represented the weevil damage in 1920. Before that year the damage ranged from 14.3 % of potential production in 1916 to 1.5 % in 1911.

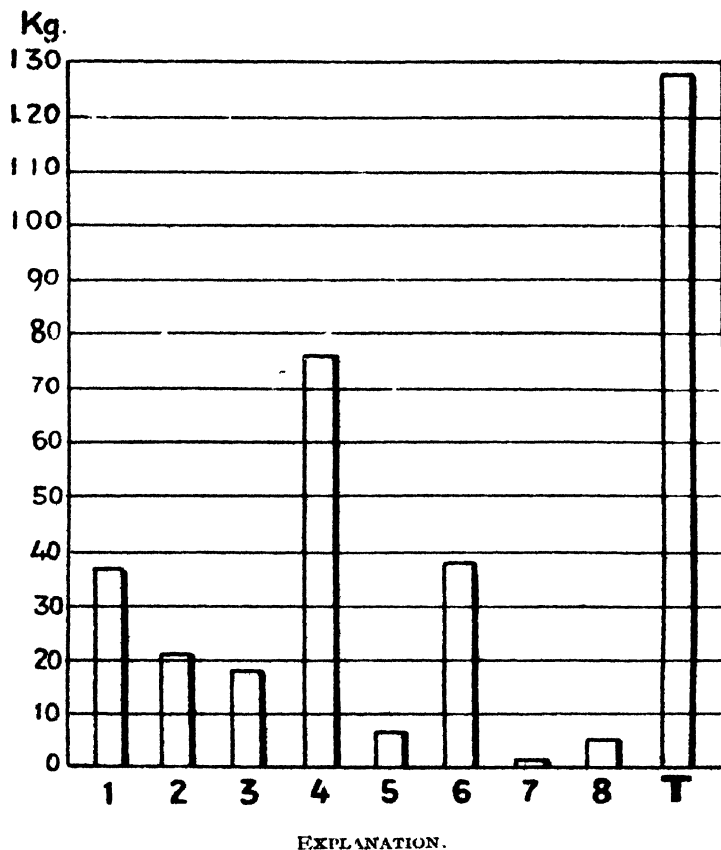
In 1921 the boll weevil became more destructive to the cotton crop than all other causes combined, having caused about 50 % of all damage while the proportion in former years had been much less.

When all causes of damage to a potential production of cotton are combined, the preceding statements made for the boll weevil alone assume an even greater significance and the causes of damage should also be considered. For example, deficient rainfall, or moisture in the ground, has damaged the cotton crop to the extent of 33.1 lbs. per acre when averaged for the years 1909-1921, and excessive moisture has damaged the crop

18.3 lbs. in the same period. All climatic causes of damage have reduced the crop by 68.5 lbs. per acre on the average.

The average toll of insect pests for the years 1909-1921 was 35.2 lbs. per acre, plant diseases 6.4 lbs. The total damage by all causes during the 13 years averaged 115 lbs. per acre.

FIG. 3. — *Average loss of Cotton. (1909-1921) (kg. per ha).*



1 = due to insufficient humidity; 2 = due to excess of humidity; 3 = for all other climatic causes; 4 = total for climatic causes; 5 = due to disease; 6 = due to insect pests; 7 = due to bad quality of seed; 8 = due to unknown causes; T = total.

All causes of damage in 1921 prevented the production of 10,717,000 bales of cotton in addition to the accompanying seed. In 1920 the production of 8,975,000 bales was prevented. That quantity, however, was exceeded in 1909 when the production of 9,369,000 bales was prevented and again in 1916 and 1918 when 9,505,000 bales and 9,136,000 bales respec-

vely, were lost from the potential crops of those years. The smallest prevention of production during the 13 years was 5,937,000 bales in 1918.

The combined damage to a potential cotton production in 1921, estimated at 10,712,000 bales, was greater than the crop actually harvested — 7,954,000 bales. In fact it was equal to the harvest and 34.7 % more, because had there been no causes of damage to the potential cotton crop of 1921, the production would have been 18,669,000 bales instead of 7,954,000 bales, and the crop that was actually secured could have been obtained from 42.6 % of the acreage under cultivation.

According to the farm value of the prevented cotton production at the price of the harvested production, the lint and seed whose production was prevented in 1921 had a hypothetical value of \$ 610 341 000, and the production prevented by all causes \$ 1 042 987 000 or much more than the actual value of the picked crop, \$ 772 583 000.

This hypothetical value of the prevented production could probably not have been a true value had such production been realized, since with a production increased by more than 75 % in 1921 it may readily be understood that the price of cotton per pound would have been much less than it was, and it is even possible that the entire production would have been less than the value of the actually harvested production. Notwithstanding the value of the prevented production as computed, is comparable to the value of the harvested crop since both have the same price per pound and since this price would fall if the causes of crop damage were removed until acreage had been reduced in accordance with the increased yield per acre.

Moreover it is an economic necessity that boll weevil damage, as well as all other forms of damage to the cotton crop, should be returned to cotton producers in the prices of cotton lint and seed as all causes of damage represent much of the cost of producing the crop that is actually harvested.

MEANS  
OF  
CONTROL

1396 — Observations on *Ithone fusca*, a Neuropteran preying on injurious Beetles, in Australia. — TILLYARD, R. J., in *Bulletin of Entomological Research*, Vol. XIII, 2nd Part, pp. 205-224, figs. 11, 2 pl. London, Aug. 1922.

A complete account of the life history of the Neuropteran *Ithone fusca* Newman, based on experiments and observations made in several districts of Australia over a period of years.

The larva of *I. fusca* lives mainly at the expense of the larvae of beetles and especially those of the Scarabaeidae. To this latter family belongs the species whose larvae, commonly called "grass grubs" cause considerable damage to meadow and pasture land in New Zealand and other parts of the world. With the object of checking the development of these injurious larvae, 5000 fertile eggs of this Neuropteran were imported from Sydney into New Zealand in October 1921, and distributed to numerous centres. In addition 750 eggs were put out in grassy plots and suitably protected in the grounds of the Cawthron Institute at Nelson (New Zealand) where there are plenty of "grass grubs" (larvae of *Odontia*). The object is to ascertain whether the larvae of *Ithone* are capable of adapting themselves to the new conditions of feeding, climate and soil. G. T.



1397 — **New Hymenoptera parasitic on injurious Insects.** — WATFRSTON, J, in *Bulletin of Entomological Research*, Vol. XIII, 2nd Part, pp 183-188, fig 5 London, Aug 1922.

A description of the following new species of Hymenoptera parasitic on injurious insects :—

1) *Chaetostricha cratitia* n. sp. obtained by rearing eggs of *Promecotheca reichei* Baly, a beetle injurious to the leaves of the Coconut palm, at Cicia (Fiji islands) ;

2) *Encyrtus cotterelli* n. sp., obtained by rearing a nymph of *Sahlbergella theobromae* Dist., a Rhynchote injurious to the cocoa tree, at Mampong (Ashanti, Gold Coast). G. T.

1398 — **Natural Enemies of Insects injurious to Forest Trees, in the United Provinces, India.** — WATFRSTON, J, in *The Indian Forest Records*, Vol. LX, 2nd Part, pp. 51-94, figs 23. Calcutta, 1922

An enumeration of various Hymenoptera collected in the United Provinces, mainly in the Dehra Dun district, during recent years.

Among them the following, known to be parasitic on insects injurious to important Indian forest trees, are particularly worthy of attention :—

1) *Chalcis tachardiae* Cam. obtained by rearing a chrysalis of *Hypsipyla robusta* a Microlepidopteron injurious to the Meliaceous tree *Cedrela Toona* Moore ("Toon") ;

2) *Ch. hearseyi* Kirby var. *xanthotenus* n. var., as in the previous case ;

3) *Trigonura ruficaudis* Cam., obtained by rearing the Sterculiaceous tree *Heritiera Fomes* Buch. ("Sundri") attacked by the beetle *Chrysobothris* sp. in company with *Glenaea* sp., *Derolus discicollis* Gah. and *Diorthus simplex* White ;

4) *T. tenuicaudis* n. sp., obtained from the same tree attacked by *Chrysobothris* sp. *Glenaea* sp., and *Ozotomerus maculosus* Perr., this new Hymenopteron is probably parasitic on *Chrysobothris* sp. ;

5) *Antrocephalus destructor* n. sp., obtained by rearing *Hypsipyla robusta* injurious to *Cedrela Toona* ;

6) *A. renalis* n. sp., obtained by rearing a chrysalis of the above mentioned Microlepidopteron ;

7) *Monacoꝝ productum* n. gen. and n. sp., obtained by rearing *Diapus furtivus* Samps., a beetle injurious to the Dipterocarp *Shorea robusta* Gaertn. ("Sal") ;

8) *M. abruptum* n. sp. obtained by breeding the beetle *Platypus uncinatus* Blandf. which attacks *Heritiera Fomes* ;

9) *Oedaule stringifrons* n. gen. and n. sp., obtained by rearing the beetle *Caryoborus gonagra* Fab., living in the seeds of the Leguminous tree *Albizia Lebbek* Benth. ;

10) *Roptrocercus sulcatus* n. sp., obtained from pupating chambers of the beetle *Ips longifolia* Stebb. in galleries excavated under the bark of *Pinus longifolia* Roxb. ("Chir") ;

11) *Tetrastichus spirabilis* n. sp., obtained by rearing caterpillars of *Hypsipyla robusta*. G. T.

- 1399 - **Disinfection of Cotton seed with Chloropicrin** (1). — VAYSSIERE, P., in *L'Agro-nomie Coloniale*, Year VII (1922-1923), No. 56, pp.249-253. Paris, Aug. 1922.

At the present time certain French Colonies, and especially French West Africa, import seeds of the most highly recommended varieties of cotton for the purpose of cultural experiments.

With the object of preventing the introduction, with these seeds, of any dangerous parasite into the Colonies and owing to the fact that the process of disinfection based on the use of heat (2) though effective, is very costly when large quantities of seed are treated, the Laboratory of Entomology at the National Institute of Colonial Agriculture, at Nogent-sur-Marne, and the Paris Entomological Station have made a series of experiments in order to obtain absolute disinfection of seeds at a minimum cost.

The insecticide selected was chloropicrin. The three experiments made in 1921 and 1922 on cotton seeds badly infested with the "pink boll worm" (*Platyedra gossypiella*) and on perfectly sound seeds have proved that a dose of 30 cubic cm. of Chloropicrin per cubic m. gives complete disinfection to seeds confined in a closed place for 24 hours, without sensibly affecting their germinative power. G. T.

- 1400 - **Selection and Treatment of Waters for Spraying Purposes.** — See No. 1882 of this Review.

- 1401 - **Pests of Rice at Sarawak, Borneo.** — See No. 1291 of this Review.

INSECTS ETC.  
INJURIOUS  
TO VARIOUS  
CROPS

- 1402 - **Observations on *Caulophilus latinasus*, a Beetle injurious to Seeds, in Florida, Georgia and South Carolina.** — COTTON, R. T., in *United States Department of Agriculture, Bulletin* 1085, pp. 19, 1 pl. Washington, D. C., July 1922.

*Caulophilus latinasus* Say has up to the present been the object of little attention from the economic standpoint and nothing had yet been published on the biology of this beetle. It is common, at the present time, in Florida and has been reported in Georgia and South Carolina. It is not impossible that the insect is spreading gradually in other parts of the South and that it increases the already considerable damage caused by *Sitophilus oryza* L. Its presence in Jamaica, Cuba, Porto Rico, Mexico, Guatemala and Madeira is well known; it is certainly common in the Antilles and in countries in Central and South America.

The damage caused by *C. latinasus* is greater than is generally supposed. While it is generally believed that it only attacks maize and chick-peas in store, it also frequently attack various seeds and the caryopses of several varieties of cereals which are rapidly reduced to a dusty mass by the combined action of the larvae and the adult insect. It should be noted that whole seeds or seeds of average hardness are quite safe from attack by this beetle, which is often found associated with *S. oryza*, the attacks of which

(1) In this connection see: — R. July-Sept. 1919, Nos. 1049-1050; R. Jan. 1920, No. 148; R. Feb. 1920, No. 271; R. March 1920, Nos. 374 and 378; R. May 1920, No. 595; R. June 1920, No. 705; R. Jan. 1921, Nos. 112 and 114; R. March 1921, No. 265; R. April 1921, No. 462. (Ed.)

(2) In this connection see: — R. January 1921, No. 115. (Ed.)

facilitate the destructive action of *C. latinasus*. Broken, damaged and soft seeds are very quickly affected. The writer here describes observations made at Orlando (Florida) on the biology and habits of *C. latinasus* in 1919, 1920 and part of 1921. He also gives a morphological description of the eggs, larva and pupa of this beetle.

The larvae of *C. latinasus* are attacked by three parasitic Hymenoptera *Cercocephala elegans* Westwood, *Aplastomorpha vandinei* Tucker and *Latropis* sp. The larvae, pupae and eggs are also attacked by the Acarid *Pediculoides ventricosus* Newport. The beetle can be effectively controlled by the typical remedies recommended for the control of insects injurious to seeds in store. G. T.

1403 - ***Apophyllia murina* and another undetermined Beetle reported for the first Time as injurious to various Crops, in Rhodesia.** — JACK, R. W., in *Bulletin* No. 425 issued by the Department of Agriculture, Salisbury, Rhodesia, 8 pp., 4 pl. Salisbury, June 1922.

In December 1918 the Department of Agriculture of Rhodesia received from a farm at Concession (Mazoe) specimens of maize attacked by an insect, together with specimens of the insect which was recognised as being *Apophyllia murina* Gerst., a Chrysomelid beetle. Four days later similar damage was described to the writer by a farmer from Enterprise and in January 1919 a large number of plants were found attacked by the insect on the land of the Agricultural Laboratories at Salisbury. During the same month on farms near Salisbury, maize was extensively but slightly attacked; the loss in one case was estimated at 5 % or more. Information, mostly circumstantial, was also received from different localities in the Mazoe valley from which it could be gathered that the insect had appeared on some farms during the previous year and that in one case thirty acres of maize has been almost completely destroyed for two consecutive years in addition to other less serious damage. In December 1919, on plots at the Experiment Station at Gwebi up to 50 % of the plants were destroyed without counting those that were only damaged. In 1920-21, with the exception of an attack reported on tobacco, no report of damage caused by the insect was received; on a farm at Concession the insect only appeared in small numbers. When maize is attacked, the centre of the plant withers and dies while the inside leaves remain green. If the plant attacked by the beetle is pulled up and the insect is still in it, a small yellow larva is found, partly and sometimes entirely located in the underground part of the stalk. Ordinarily a single larva causes the death of the plant if fairly young, or it hinders growth to such an extent that the ears produced are of little value.

Little is yet known of the life history and habits of the insect. When the larva has reached complete development, it builds a shelter in the ground and pupates. Larvae collected in January produced the first beetles 19 days later. The insect breeds several times a year. The beetles feed on the leaves of maize and other Gramineae, but it is not certain that these plants are their preferred hosts. Besides maize, the larvae feed readily

on the underground parts of the stalks of *Eleusine indica* Gaertn. ("Rapo grass"); it may be supposed that this wild Grass may have a very great influence on the appearance of the beetle by supplying it with suitable food at a time when maize stubble is too hard to be attacked. Other Gramineae are no doubt attacked by the larvae which also feeds on the fruit of the groundnut and the underground parts of tobacco stalks. It has also been reported that the insect can attack and destroy in the ground caryopses of maize about to germinate. Many young plants are thus killed by larvae which bore into the lowest parts. Sometimes several larvae attack a single plant but the writer has never seen more than two such cases.

The strongest plants or those which are less damaged often send out buds below the point attacked; deformed plants are the result, often with two stalks and the ears being almost valueless.

Apparently the insect prefers certain kinds of soils. A farmer in the Mazoe valley who has suffered very heavy loss from the beetle has stated that the beetle mainly attacks maize growing in the lighter coloured soils, seldom that on chocolate coloured soils and never those on black soil. All the attacks seen by the writer were on red or yellow soils, but he does not exclude the possibility that the insect may cause damage also on other soils.

In January 1913 it was reported to the Department of Agriculture that in the Hartley district a small pink larva was attacking the underground parts of sorghum stalks and the germinating caryopses. About fifteen acres had to be resown. The specimens received for examination made it possible to decide that they were larvae of an undetermined beetle. During that month the same insect attacked the sorghum in experimental plots at Salisburg, over 50 % of the plants were destroyed. Adult specimens obtained by artificial rearing and others captured in the open were sent for identification to Dr. PERINGUEY of the South African Museum who recognised that the insect not only belonged to an undescribed species but also to a new genus which might no doubt be placed in the family *Melyridae*. Up to the present the beetle has not been named and is therefore indicated here under the common name of "pink grub", which has been given to the larva. Ordinarily the beetles are very abundant on the panicles of *Tricholaena rosea* Nees ("Natal red-topped grass") and of *Poa abyssinica* Jacq. ("teff grass") in April and May, and they feed, apparently, mainly or almost exclusively on the pollen.

The life history and habits of this insect are not at present fully known.

So far as has been observed up to the present, the larvae behave like those of *Apophyllia murina*; they feed on the underground parts of sorghum stalks and destroy the lower portions in such a way that the centre of the plant withers. They also at the same time attack maize but do not appear to be able to penetrate into the more vigorous stalks, as is the case with the larvae of *Apophyllia* and although damage to maize has been observed and reported it is not comparable with that caused by *A. murina* when

the insect is found in large numbers. The larvae of the second beetle also attack young roots and show a tendency to eat the germinating caryopses of sorghum and maize. They have also been found on the roots of peas, beans, *Vigna Catjang*, etc. and have been reported as injurious at any rate to peas. It is not quite clear whether the larva attacks this crop to any considerable extent but on one occasion it was found entirely imbedded in the stalk of a plant of *V. Catjang* which was also attacked by *Agromyza* sp. Owing to the preference of the beetles for the inflorescences of *Trich. rosea* and *P. abyssinica*, it is probable that the presence of one or other of these grasses may have a direct influence on the infestation of the soil by the larvae. G. T.

1404 - **Phylloxera of the Vine in Greece.** — See No. 1317 of this *Review*.

1405 - **Pests of the Date Palm in Irak.** — See No. 1316 of this *Review*.

1406 - **Animal Pests of *Artocarpus* spp. and *Tectona grandis*, in the Dutch Indies.** — KALSHOVEN I, in *Tectona*, Year XV, No. 8, pp. 677-693, 1 fig. Buitenzorg, Aug. 1922.

*Artocarpus integra* Morr., used in mixed forest plantations in the interior of the island of Java, is attacked by the Microlepidopteron *Marcophanes caesalis* Wlk. (Syn. of *Glyphodes cramerialis* Snell.). After many caterpillars suffer from arrested growth and become much smaller than the normal caterpillars of the species. The young caterpillars in the latter case are found in the west of Java on *A. integra*. As they grew older the caterpillars perforated the medulla of the shoots and made galleries in which they pupated. In 1920 and 1921 the caterpillars were observed from January to March. It is supposed that they may develop for a part of the year in the floral buds and young fruit of the host, since caterpillars have been observed in India on *A. integra* exactly in such places.

No definite method of control of the insect can be indicated, for the biological data collected regarding it are too incomplete. The removal and destruction of the infested shoots and simultaneous pruning of the lateral branches might be tried, but in practice this may be difficult and it may be the case that such operations cannot be carried out over large areas.

Neither insects nor fungi injurious to the fruit of *Tectona grandis* L. f. are known. The great variations observed in the production of fruit are probably due to meteorological factors. However part and perhaps a large proportion of the fruit may be damaged by higher animals. The damage they cause does not appear to have any economic importance since no difficulties have been experienced in providing seed required for plantations. The natives state that the fruit of *Tectona* is eaten on the trees by parrots (very probably *Palaeornis alexandri* L.), by small and large Rodents (*Sciurus* spp.) and by monkeys, while fallen

fruit appears to be eaten by rats. These statements may be true require confirmation.

Fruit has been found broken, generally longitudinally and sometimes transversally, probably by parrots and some of the seeds show clear marks of the action of a beak. A case may be mentioned in which parrots were seen actually breaking the fruit of *Tectona* on the tree. Many fruits have also been found gnawed at the top by Rodents. As these fruits lie on the ground in the middle of dry leaves with the remainder of the shells removed, it has been supposed that small Rodents (*Sciurus* spp.) extracted the seeds from the fruit on the trees and dropped the remainder. Perhaps other climbing Rodents (*Pteromys*, *Sciuropterus*) do the same.

It is said that a larger Rodent (*Sciurus bicolor*) cracks the fruit in two; it has been observed about to eat the fruit, but there is no further information on the subject. The fruit of *Tectona* may be opened by Rodents in yet another manner, namely by making a single hole near the base; perhaps the fruit is gnawed on the trees by climbing Rodents or on the ground by rats (or by *Hystrix javanica* Cuv.). The writer has also found some fruits with 3 or 4 small separate holes near the top, which in this case was intact. Perhaps in this case the damage was due to a climbing Rodent.

Some *Macacus cynomolgus* have been seen on the point of touching the *Tectona* fruit on the trees; perhaps they eat them. Recently a *Semnopithecus maurus* Schreb. was surprised when about to take fruits on the top of a tree and crack them with its teeth.

G. T.

(1406)

INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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INTERNATIONAL REVIEW  
OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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## THE INTERNATIONAL INSTITUTE OF AGRICULTURE

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The Institute, always confining its attention to the international aspect of the various questions concerned, shall :

(a) collect, study and publish as promptly as possible, statistical, technical, or economic information concerning farming, vegetable and animal products, trade in agricultural produce and the prices prevailing in the various markets ;

(b) communicate the above information as soon as possible to those interested ;

(c) indicate the wages paid for farm work ;

(d) record new diseases of plants which may appear in any part of the world, showing the regions infected, the progress of the diseases, and if possible, any effective remedies ;

(e) study questions concerning agricultural co-operation, insurance and credit from every point of view ; collect and publish information which might prove of value in the various countries for the organization of agricultural co-operation, insurance and credit ;

(f) submit for the approval of the various governments, if necessary, measures for the protection of the common interests of farmers and for the improvement of their condition, and for this purpose all available sources of information, such as resolutions passed by international or other agricultural congresses and societies, or by scientific and learned bodies, etc.

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In case of errors in the *Review* with reference to scientific terms and the names of authors, it should be noted that the correct spelling can be relied upon in the Index.

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#### IV. — WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES WITH THEIR ENGLISH EQUIVALENTS.

1 Archine (Russia)	= 27.99961 inches
1 Ardeb (Egypt)	= 5.44435 bushels
1 Ardeb of wheat (Egypt)	= 2.95264 cwt.
1 Ardeb of hulled maize (Egypt)	= 2.73580 cwt.
1 Ardeb of barley (Egypt)	= 2.36211 cwt.
1 Ardeb of undecorticated rice (Egypt)	= 5.72812 cwt.
1 Ardeb of decorticated rice (Egypt)	= 3.83843 cwt.
1 Arpent (Canada)	= 0.84501 acres
1 Are [100 square metres]	= 107.63915 square feet
1 Arroba (Brazil)	= 33.06951 lbs.
1 Arroba (Cuba, Guatemala, Paraguay, Peru)	= 25.35841 lbs.
1 Arroba (Mexico)	= 25.36687 lbs.
1 Bale of cotton (Brazil)	= 396.83415 lbs.
1 Bale of cotton (United States)	= 4.46431 cwt. (gross wt.)
1 " " " " "	= 4.26788 cwt. (net wt.)
1 Bale of cotton (India)	= 3.57145 cwt.
1 Barrel of wheat flour (Canada, United States)	= 1.75001 cwt.
1 Bar, see Millier	
1 Bow (Java, Dutch Indies)	= 76.36998 square feet
1 Bushel (United States)	= 0.96896 bushels
1 Bushel of oats (United States)	= 32 lbs.
1 Bushel of oats (Canada)	= 34 lbs.
1 Bushel of wheat and potatoes (United States)	= 60 lbs.
1 Bushel of barley (Canada, United States)	= 48 lbs.
1 Bushel of raw rice (United States)	= 45 lbs.
1 Bushel of rye, hulled maize, linseed (Canada, United States)	= 56 lbs.
1 Cadastral arpent (Hungary)	= 1.42201 acres
1 Cental (United States)	= 100 lbs.
1 Centiare [10 square metres]	= 10.76392 square feet
1 Centigramme	= 0.15432 grains
1 Centilitre	= 0.0022 gallons
1 Centimetre	= 0.393715 inches
1 Centistere	= 0.35315 cubic feet
1 Centner (Germany, Austria, Denmark)	= 110.23171 lbs.
1 Centner (Sweden)	= 93.71238 lbs.
1 Cho [60 ken] (Japan)	= 119.30327 yards
1 Cho (Japan)	= 2.45068 acres
1 Crown [100 heller] (Austria-Hungary)	= 10 d at par
1 Crown [100 öre] (Denmark, Norway, Sweden)	= 18 1/16 d at par
1 Cubic centimetre	= 0.06102 cubic inches
1 Cubic metre	= 1.30795 cubic yards
1 Decagramme [10 grammes]	= 0.35275 oz.

1 Decalitre [10 litres]	= 2.19976 gallons
1 Decametre [10 metres]	= 32.80840 feet
1 Decare [1000 square metres]	= 1195.98627 square yards
1 Decastere [10 cubic metres]	= 13.07951 cubic yards
1 Decliare [10 square metres]	= 11.95986 square yards
1 Deciatine [2 tchetwert] (Russia)	= 2.69966 acres
1 Decigramme	= 1.54323 grains
1 Decilitre	{ = 0.022 gallons
	{ = 0.0027497 bushels
1 Decimetre	= 3.93701 inches
1 Decistere	= 3.53146 cubic yards
1 Dinar, gold [100 para] (Serbia)	= 9 <sup>11</sup> / <sub>16</sub> d at par
1 Dollar, gold, \$ [100 cents] (United States)	= 4 s 1 <sup>1</sup> / <sub>16</sub> d at par
1 Drachm, gold [100 lepta] (Greece)	= 9 <sup>11</sup> / <sub>16</sub> d at par
1 Dz. = Doppelzentner (Germany)	= 220.46341 lbs.
1 Egyptian kantar (Egypt)	= 99.04980 lbs.
1 Feddan Masri [24 Kirat Kamel] (Egypt)	= 1.03805 acres
1 Florin, gold, or Gulden [100 cents] (Netherlands)	= 1 s 7 <sup>11</sup> / <sub>16</sub> d at par
1 Franc [100 centimes] (France)	= 9 <sup>11</sup> / <sub>16</sub> d at par
1 Gallon (United States)	= 0.83270 gallons
1 gramme	= 0.03527 oz.
1 Hectare [10 000 square metres]	= 2.47109 acres
1 Hectogramme (100 grammes)	= 3.52746 oz.
1 Hectolitre [100 litres]	{ = 21.99755 gallons
	{ = 2.74967 bushels
1 Hectometre [100 metres]	= 109.36133 yards
1 Hectostere [100 cubic metres]	= 130.79505 cubic yards
1 Jarra (Mexico)	= 7.22642 quarts
1 Kadastral hold, see Cadastral arpent	
1 Kin (Japan)	= 1.32278 lbs.
1 Kokou [10 to] (Japan)	= 1.58726 quarts
1 Kokou of oats (Japan)	= 1.55014 cwt.
1 Kokou of cocoons (Japan)	= 82.67268 lbs.
1 Kokou of wheat and maize (Japan)	= 2.58356 cwt.
1 Kokou of barley (Japan)	= 2.06685 cwt.
1 Kokou of naked barley (Japan)	= 2.69428 cwt.
1 Kokou of rice (Japan)	= 2.80501 cwt.
1 Kopek (Russia)	= 1 <sup>1</sup> / <sub>100</sub> farthing at par
1 Kwan (Japan)	= 8.26738 lbs.
1 Lei, gold [100 bani] (Rumania)	= 9 <sup>11</sup> / <sub>16</sub> d at par
1 Leu [100 statinki] (Bulgaria)	= 9 <sup>11</sup> / <sub>16</sub> d at par
1 Lira [100 centesimi] (Italy)	= 9 <sup>11</sup> / <sub>16</sub> d at par
1 Litre	{ = 0.21998 gallons
	{ = 0.0275 bushel
1 Manzana (Nicaragua, Guatemala)	= 1.72665 acres
1 Mark [100 Pfennige] (Germany)	= 11 <sup>1</sup> / <sub>16</sub> d at par
1 Mark [100 penni] (Finland)	= 9 <sup>11</sup> / <sub>16</sub> d at par

1 Maund (India)	= 74.965 lbs.
1 Maund Imperial (India)	= 82.2875 lbs.
7 Metre	= 3.28084 feet
1 Milliare	= 7.77639 square feet
1 Milligramme	= 0.01543 grains
1 Millilitre	= 0.00022 gallons
1 Millimetre	= 0.03937 inches
1 Millistere	= 61.02361 cubic inches
1 Myriagramme [10 000 grammes]	= 22.7 lbs.
1 Myrialitre [10 000 litres]	{ = 2 199.7539 gallons
	{ = 274.96701 bushels
1 Myriametre [10 000 metres]	= 6.21373 miles
1 Millier [1 000 000 grammes]	= 19 68426 cwt.
1 Milreis, gold (Brazil)	= 2s 2 <sup>11</sup> / <sub>16</sub> d at par
1 Milreis, gold (Portugal)	= 4s 5 <sup>11</sup> / <sub>16</sub> d at par
1 Minot (Canada)	= 1.07306 bushels
1 Morgen (Cape of good Hope)	= 2.11654 acres
1 Muid (Cape of good Hope)	{ = 24 gallons
	{ = 3 bushels
1 Oka (Greece)	= 2.75579 lbs.
1 Oke (Egypt)	= 2.75138 lbs.
1 Peseta, gold [100 céntimos] (Spain)	= 9 <sup>11</sup> / <sub>16</sub> d at par
1 Peso, gold [100 centavos] (Argentina)	= 3s 11 <sup>11</sup> / <sub>16</sub> d at par
1 Peso, gold [100 centavos] (Chili)	= 1s 5 <sup>11</sup> / <sub>16</sub> d at par
1 Pic (Egypt)	= 2.46646 feet
1 Pikul (China)	= 133 27675 lbs.
1 Pikul (Japan)	= 132.27805 lbs.
1 Poud (Russia)	= 36 11292 lbs.
1 Pound, Egyptian, gold [100 piastres]	= £1 0.6 <sup>11</sup> / <sub>16</sub> at par
1 Pound, Turkish, gold [100 piastres] (Ottoman Empire)	= 18s 0 <sup>11</sup> / <sub>16</sub> d at par
1 Pund (Sweden)	= 0.93712 lbs.
1 Quintal	= 1.96843 cwt.
1 Rouble, gold [100 kopeks] (Russia)	= 2s 1 <sup>11</sup> / <sub>16</sub> d at par
1 Rupee, silver [16 annas] (British India)	= 1s 4 d at par
1 Square metre	= 1 19599 square yards
1 Stere [1 cubic metre]	= 1.30795 cubic yards
1 Sucre, silver (Ecuador)	= 1s 11 <sup>11</sup> / <sub>16</sub> d at par
1 Talari [20 piastres] (Egypt)	= 4s 1 <sup>11</sup> / <sub>16</sub> d at par
1 To (Japan)	{ = 0.49601 bushels
	{ = 3.96815 gallons
1 Ton (metric)	= 0.98421 tons
1 Verst (Russia)	= 1166.64479 yards
1 Yen, gold [2 fun or 100 sen] (Japan)	= 2s 0 <sup>11</sup> / <sub>16</sub> d at par
1 Zentner (Germany)	= 110.23171 lbs.







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